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Synthesis and Growth Promoting Effects of Some Newly Synthesized Chlorosubstituted Heterocycles on Agricultural Crop Plants

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In the present study, the synthesis and growth promoting effects of 4-aroylpyrazolines, pyrazoles, isoxazolines and isoxazoles on cultivated agricultural crop plants, namely, *Triticum aestivum* (wheat), *Sorghum vulgare* (jowar), *Cicer arietinum* (gram) and *Phaseolus vulgaris* (Rajma) were undertaken.

Key Words: 4-Aroylpyrazolines, Pyrazoles, Isoxazolines, Isoxazoles, *Triticum aestivum*, *Sorghum vulgare*, *Cicer arietinum*, *Phaseolus vulgaris*.

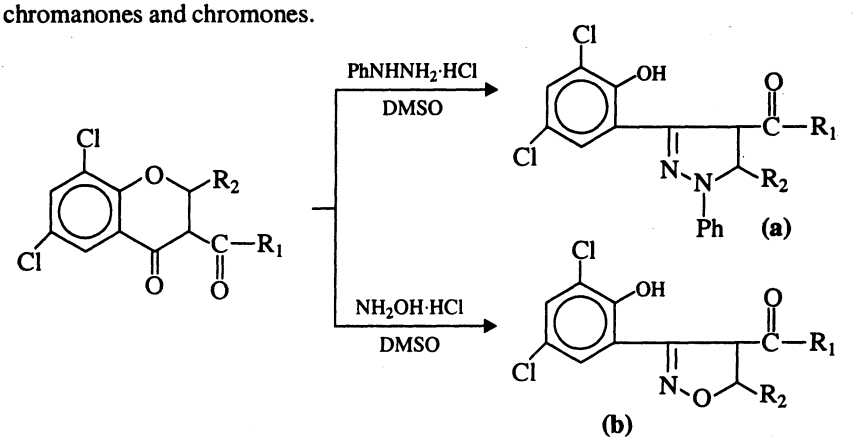
INTRODUCTION

The newly synthesized chlorosubstituted heterocycles pyrazolines, pyrazoles, isoxazolines and isoxazoles were assayed for their growth promoting effects on *Triticum aestivum* (Wheat), *Sorghum vulgare* (Jowar), *Cicer arietinum* (Chana) and *Phaseolus vulgaris* (Rajma) with predetermined periodicity.

EXPERIMENTAL

(A) Synthesis of chlorosubstituted heterocyclic compounds

The 4-aroylpyrazolines and pyrazoles were prepared hy the treatment of phenylhydrazine hydrochloride on 3-aroylflavanones, 3-aroylflavones, chromanones and chromones while 4-aroylisoxazolines and isoxazoles were prepared by the treatment of hydroxylamine hydrochloride on 3-aroylflavanones, 3-aroylflavones, chromanones and chromones.



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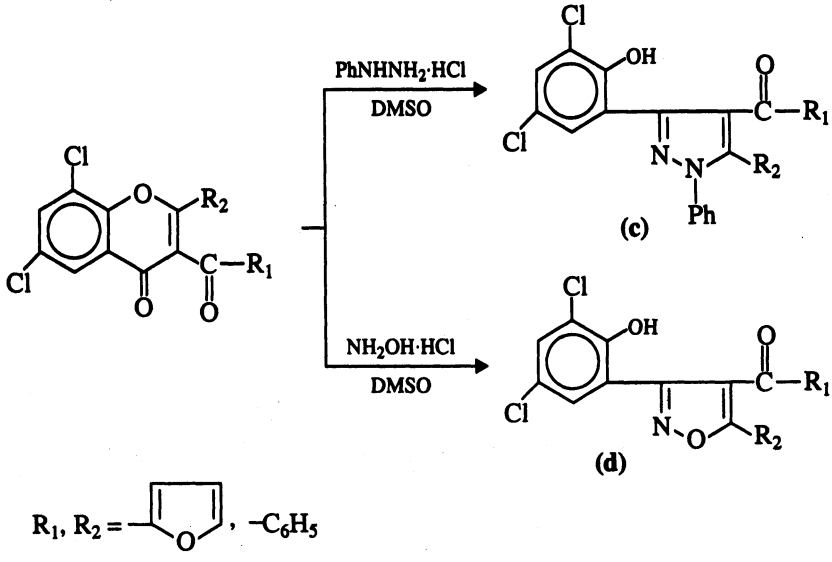

The spectral analyses of (**a–d**) are given below:

(a) IR 3450 ν(O—H), 1600 ν(C=O), 1560 ν(C=N), 1250 ν(C—O), 925 ν(2′-furyl), 795 ν(C—Cl).
PMR: 5.10 (d) (1H), 5.43 (d) (1H), 6.75–8.19 (m) (15H), 9.5 (s) (1H).

(b) IR 3400 ν(O—H), 1640 ν(C=O), 1602 ν(C=N), 1240 ν(C—O), 924 ν(2′-furyl), 810 ν(C—Cl).
PMR: 5.4 (d) (1H), 5.9 (d) (1H), 6.00–8.34 (m) (12H), 12.74 (s) (1H).

(c) IR 3403 ν(O—H), 1625 ν(C=O), 1560 ν(C=N), 1256 ν(C—O), 921 ν(2′-furyl), 752 ν(C—Cl).
PMR: 6.68–7.99 (15H), 12.08 (1H).

(d) IR 3401 ν(O—H), 1628 ν(C=O), 1457 ν(C=N), 1261 ν(C—O), 921 ν(2′-furyl), 751 ν(C—Cl).
PMR: 6.75–8.11 (m) (10H), 10.25 (s) (1H).

Pre-germinated quality seeds of *Triticrm aestivum, Sorghum vulgare, Cicer arietinum* and *Phaseolus vulgaris* were procured from Krishi Vidnyan Kendra, Badnera, Distt. Amravati (M.S.), India. The beds of black cotton soil, of 2.5 × 2.5 metre size were prepared on an open field. The seeds of all four species under examination were sowed in these beds separately by conventional method. The plant beds were irrigated as and when required with tap water. The plants from each bed were divided into two groups (A) and (B). The group (A) plants were kept unsprayed and termed as control group, whereas the plants from group (B) designated as treated group (B) plants were sprayed with the compounds being tested. The seeds of group (B) were also treated with test compounds before sowing to screen growth promoting effects. The spraying solutions of newly synthesized chlorosubstituted heterocyclic compounds pyrazolines, pyrazoles, isoxazolines and isoxazoles were prepared in dioxane (0.01 dilution) separately and sprayed thrice at fortnightly intervals (15, 30, 45 days).

All the field experiments were conducted to compare the treated plants of group (B) with the plants from control group (A). The samples were taken at 15, 30, 45, 60, 75 and 90 days after sowing, corresponding to early vegetative, late vegetative, pod filling and pod maturation stages. The plants were carefully examined and the number of leaves and heights of shoots were recorded (Table-1 a–d) The data obtained was subjected to analysis of growth parameters.

TABLE-1 (a)
EFFECT OF NEWLY SYNTHESIZED COMPOUND (6a) ON THE GROWTH OF CULTIVATED CROPS

Name of the test compound	Periodicity of the observation (days)	Cultivated crops															
		Triticum aestivum				*Sorghum vulgare*				*Cicer arietinum*				*Phaseolus vulgaris*			
		Shoot height		No. of cells		Shoot height		No. of cells		Shoot height		No. of cells		Shoot height		No. of cells	
		C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T
3-(2-hydroxy-3,5-dichloro-phenyl)-5-(2′-furyl)-1-phenyl-Δ_2-pyrazoline (6a)	15	11	9	2	7	8	13	4	8	4	7	13	15	8	10	5	12
	30	11	20	5	15	15	30	12	17	8	13	28	40	12	20	15	21
	45	21	30	7	25	26	48	18	25	14	22	66	99	17	32	18	28
	60	25	36	7	28	40	65	27	35	21	27	98	140	21	40	21	36
	75	26	38	2	25	45	70	15	20	22	30	62	90	25	44	17	29
	90	26	38	3	20	51	75	10	15	22	31	51	78	28	46	14	16

C = Control; T = Treated.

TABLE-1 (B)

Name of the test compound	Periodicity of the observation (days)	Cultivated crops															
		Triticum aestivum				*Sorghum vulgare*				*Cicer arietinum*				*Phaseolus vulgaris*			
		Shoot height		No. of cells		Shoot height		No. of cells		Shoot height		No. of cells		Shoot height		No. of cells	
		C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T
3-(2-hydroxy-3,5-dichloro-phenyl)-5-(2′-furyl)-1-phenylpyrazoline (8a)	15	6	10	2	8	9	14	5	9	6	8	–	–	10	12	11	13
	30	11	20.5	6	16	16	25	13	18	9	14	29	42	14	21	16	22
	45	21.5	31	8	20	25	49	19	24	13	21	65	92	16	33	19	27
	60	24	37	8	29	41	70	28	36	22	28	99	87	22	40	21	36
	75	27	40	3	25	44	69	15	21	22	32	62	89	25	45	18	30
	90	25	39	4	19	52	74	11	18	22	34	57	75	29	46	15	17

C = Control; T = Treated.

TABLE-1 (c)

Name of the test compound	Periodicity of the observation (days)	Cultivated crops															
		Triticum aestivum				*Sorghum vulgare*				*Cicer arietinum*				*Phaseolus vulgaris*			
		Shoot height		No. of cells		Shoot height		No. of cells		Shoot height		No. of cells		Shoot height		No. of cells	
		C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T
3-(2-hydroxy-3,5-dichloro-phenyl)-4-benzoyl-5-(2'-furyl)-isoxazoline (9a)	15	5.5	10.5	2	8	7	14	5	7	5	8	14	16	9	11	6	13
	30	11.5	20	6	16	15	30	13	18	8	13	27	39	13	20	15	20
	45	22	29	7	25	27	48	19	26	13	22	70	101	18	32	17	27
	60	24	37	8	27	41	64	26	34	22	28	99	152	22	41	29	36
	75	26	38	2	26	46	70	16	20	21	–	61	90	26	45	16	30
	90	24	40	2	20	52	74	10	16	21	31	32	79	30	46	15	17

C = Control; T = Treated.

TABLE-1 (d)

Name of the test compound	Periodicity of the observation (days)	Cultivated crops															
		Triticum aestivum				*Sorghum vulgare*				*Cicer arietinum*				*Phaseolus vulgaris*			
		Shoot height		No. of cells		Shoot height		No. of cells		Shoot height		No. of cells		Shoot height		No. of cells	
		C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T
3-(2-hydroxy-3,5-dichloro-phenyl) -4-benzoyl)-5-(2'5-(2'-furyl)-isoxazoline (10a)	15	6	11.5	3	7	8	14	6	8	53	8	13	17	9	10	9	14
	30	12	21	6	15	16	32	12	18	10	14	24	41	14	21	16	24
	45	22	30	7	24	25	40	15	20	16	21	57	77	18	33	19	27
	60	24	35	8	29	35	65	28	37	219	26	98	120	20	41	25	37
	75	26	37	2	24	37	72	19	24	22	31	69	100	24	45	23	36
	90	27	38	4	21	52	74	17	21	21	32	65	58	28	48	19	30

C = Control; T = Treated.

RESULTS AND DISCUSSION

Efforts have been made to investigate and analyze the convergence and divergence of the effects of test compounds on the morphology of plants under investigation. When the first comparison of morphological characters was made between those of treated and control group plants, it was interesting to note that all the treated plants exhibited remarkable shoot growth, and considerable increase in the number of leaves as compared to the untreated ones[1-6].

When all the treated plants were compared among themselves, it was distinctly

observed that the dicots showed a more pronounced vegetative growth than the monocots[1-6].

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