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

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ABSTRACT

In the present study, the synthesis and growth promoting effects of 4-aroylpyrazolines on cultivated agricultural crop plants namely, Triticum aestivum (Wheat), Sorghum vulgare (Jowar), Cicer arietinum (Gram) and Phaseolus vulgaris (Rajma) were undertaken.

Keywords: 4-aroylpyrazolines, *Triticum aestivum* (Wheat), *Sorghum vulgare* (Jowar), *Cicer arietinum* (Gram) and *Phaseolus vulgaris* (Rajma).

INTRODUCTION

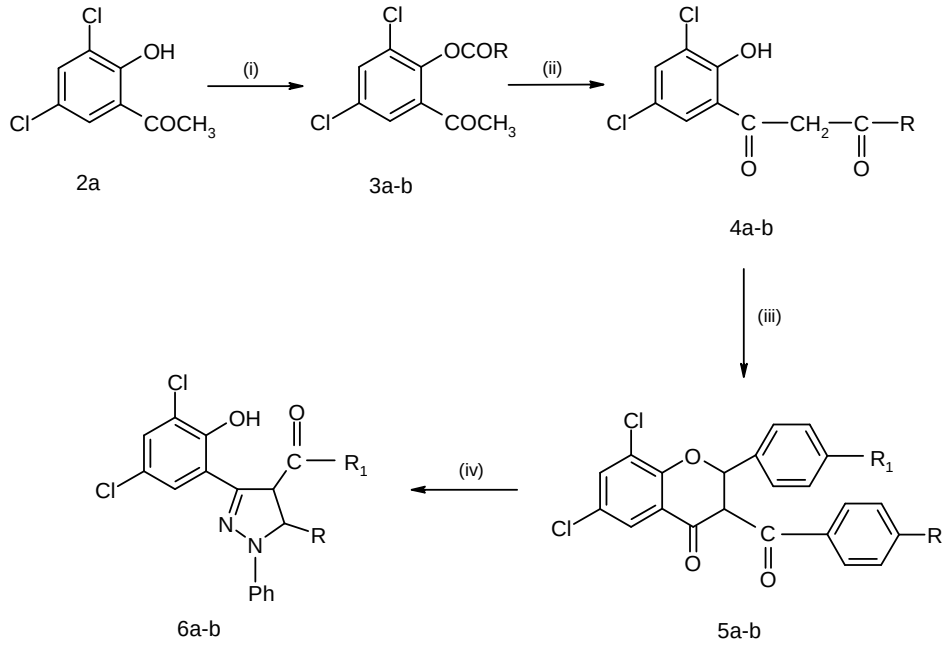
The newly synthesized chlorosubstituted pyrazolines were assayed for their growth promoting effects on *Triticum aestivum* (Wheat), *Sorghum vulgare* (Jowar), *Cicer arietinum* (Chana) and *Phaseolus vulgaris* (Rajma) with predetermined periodicity.

A] Synthesis of chlorosubstituted pyrazolines

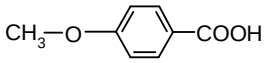
A mixture of 3-aroylflavanone (0.01 mol) and phenyl hydrazine hydrochloride ($PhNHNH_2$.HCl) (0.02 mol) in dioxane (20 ml) containing a few drops of piperidine was refluxed for 2.5 h. After cooling, the reaction mixture was acidified with dil. HCl (1:1). The solid product thus obtained was crystallized from ethanol-acetic acid mixture to get 4-aroylpyrazolines. It gives colouration with neutral $FeCl_3$ solution and dissolve in NaOH indicating thereby the presence of free phenolic -OH group.

The spectral analysis of the compound (5) and compound (6) are given below:
(1d) IR (cm^{-1}): 1655 ν (>C=O), 1600 ν (>C=O), 1224 ν (C–O), 820 ν (C–Cl)
(1d) PMR (δppm) : 3.69 (s 3H Ar–OCH_3), 5.36 (d 1H CH_A–CH), 5.76 (d 1H CH–CH_B) and 6.73 to 8.17 (m 10H Ar–H)
(2d) IR (cm^{-1}): 3100-3000 ν (O–H), 1650 ν (>C=O), 1600 ν (>C=N), 1990 ν (Ar–O–C), 821 ν (C–Cl)

(2d) PMR (δppm): 3.89 (s 3H Ar–OCH_3), 5.27 (d 1H CH_A–CH), 5.65 (d 1H CH–CH_B), 6.62 to 8.18 (m 16H Ar–H), 12.08 (s 1H Ar–OH)



Where
R :-
a = C_6H_5
b = C_6H_4-O-CH_3
R_1 :-
a = C_6H_5
b = C_6H_4-O-CH_3
i) 2a = C_6H_5COCl, 10% NaOH

2b =  Dry pyridine, $POCl_3$

ii)KOH, Pyridine
iii)Benzaldehyde, Piperidine
Anisaldehyde, Piperidine
iv)$PhNHNH_2$.HCl + DMSO + Piperidine

Table 1 Physical and analytical characterization of data of newly synthesized compounds

Compd.	Mol. Formula	Mol. Wt.	R	R_1	Yield (%)	m.p. (°C)	Found (Calcd.) %		R_f
							C	N	
2b	$C_8H_6Cl_2O_2$	205			75	53			
3a	$C_{15}H_{10}O_3Cl_2$	308	$-C_6H_5$		75	65	58.16		
3b	$C_{16}H_{12}O_4Cl_2$	338	$-C_6H_5OCH_3$		75	112	46.45		
4a	$C_{15}H_{10}O_3Cl_2$	308	$-C_6H_5$		75	112	58.19		
4b	$C_{16}H_{12}O_4Cl_2$	338	$-C_6H_5OCH_3$		80	115	56.50		
5a	$C_{24}H_{18}O_5Cl_2$	457	$-OCH_3$	$-OCH_3$	80	165	62.99		.44
5b	$C_{22}H_{14}O_3Cl_2$	397	–H	–H	85	156	66.40		.42
5c	$C_{23}H_{16}O_4Cl_2$	427	–H	$-OCH_3$	80	160	64.57		.85
5d	$C_{23}H_{16}O_4Cl_2$	427	$-OCH_3$	–H	75	175	64.55		.61
6a	$C_{30}H_{24}O_4N_2Cl_2$	547	$-OCH_3$	$-OCH_3$	70	170	65.70	5.02	.36
6b	$C_{28}H_{20}O_2N_2Cl_2$	487	$-C_6H_5$	$-C_6H_5$	70	174	68.60	5.65	.60
6c	$C_{29}H_{22}O_3N_2Cl_2$	517	$-C_6H_5$	$-C_6H_5$	80	169	67.26	5.35	.64
6d	$C_{29}H_{22}O_3N_2Cl_2$	517	$-C_6H_5$	$-OCH_3$	60	160	67.25	5.36	.62

The beds of black cotton soil of 2.5 x 2.5 metre size were prepared on an open field. Pre-germinated quality seeds of *Triticum aestivum*, *Sorghum vulgare*, *Cicer arietinum* and *Phaseolus vulgaris* were procured from Krishi Vidnyan Kendra, Badnera, Dist. Amravati (M.S.), India. 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). A 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 solution of newly synthesized chlorosubstituted pyrazolines were prepared in dioxane (0.01 dilution) separately and sprayed thrice at fortnightly intervals (15, 30, 45, 60, 75 and 90 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 2 to 5). The data obtained was subjected to analysis of growth parameters.

Table 2 Effect of 3-(2-hydroxy-3, 5-dichlorophenyl)-4-anisoyl-5-(4'-methoxyphenyl)-1-phenyl-Δ^2-pyrazoline (6a)

Periodicity of the observation	Cultivated crops															
	Triticum aestivum				*Sorghum vulgare*				*Cicer arietinum*				*Phaseolus vulgaris*			
	Shoot height		No. of leaves		Shoot height		No. of leaves		Shoot height		No. of leaves		Shoot height		No. of leaves	
	C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T
15	10	10	3	5	7	12	5	6	5	7	12	14	9	11	6	12
30	11	20	5	14	12	30	13	15	8	12	25	40	12	20	15	21
45	20	32	8	20	24	40	15	25	12	24	40	60	16	30	18	28
60	25	40	9	25	40	70	27	36	22	28	90	145	20	40	25	38
75	27	39	4	30	45	70	15	20	23	35	63	85	25	40	16	30
90																

Table 3 Effect of 3-(2-hydroxy-3, 5-dichlorophenyl)-4-benzoyl-1,5-diphenyl-Δ^2-pyrazoline (6b)

Periodicity of the observation	Cultivated crops															
	Triticum aestivum				*Sorghum vulgare*				*Cicer arietinum*				*Phaseolus vulgaris*			
	Shoot height		No. of leaves		Shoot height		No. of leaves		Shoot height		No. of leaves		Shoot height		No. of leaves	
	C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T
15	4	8	2	7	9	13	5	9	7	9	21	30	11	15	10	14
30	12	20	6	17	17	30	12	16	8	15	29	42	13	24	17	24
45	21	30	9	15	24	40	19	25	12	22	60	91	17	30	18	25
60	23	30	8	28	40	75	27	37	21	29	80	87	21	41	20	32
75	26	41	4	21	44	69	16	22	22	33	61	81	24	46	20	33
90	25	35	5	20	55	70	12	20	23	35	51	70	26	46	15	20

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 interesting to note that all the treated plants exhibited remarkable shoot growth, and considerable increase in the number of leaves as compared to 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]

Table 4 Effect of 3-(2-hydroxy-3, 5-dichlorophenyl)-4-benzoyl-5-(4'-methoxyphenyl)-1-phenyl-Δ^2-pyrazoline (6c)

Periodicity of the observation	Cultivated crops															
	Triticum aestivum				*Sorghum vulgare*				*Cicer arietinum*				*Phaseolus vulgaris*			
	Shoot height		No. of leaves		Shoot height		No. of leaves		Shoot height		No. of leaves		Shoot height		No. of leaves	
	C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T
15	6	10	2	7	7	15	6	8	5	8	13	15	10	12	10	13
30	11	21	6	15	14	32	13	18	7	13	29	39	12	21	17	22
45	20	28	8	24	29	49	20	25	12	23	71	100	19	33	15	29
60	24	36	9	27	40	65	22	31	20	27	91	130	21	35	28	39
75	27	38	3	25	45	71	17	21	21	25	65	89	25	47	15	32
90	23	41	3	21	51	70	11	17	22	30	31	85	30	45	19	21

Table 5 Effect of 3-(2-hydroxy-3, 5-dichlorophenyl)-4-(4'-methoxyphenyl)-1,5-diphenyl-Δ^2-pyrazoline (6d)

Periodicity of the observation	Cultivated crops															
	Triticum aestivum				*Sorghum vulgare*				*Cicer arietinum*				*Phaseolus vulgaris*			
	Shoot height		No. of leaves		Shoot height		No. of leaves		Shoot height		No. of leaves		Shoot height		No. of leaves	
	C	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T
15	7	12	4	8	9	13	7	9	54	8	13	18	10	11	10	15
30	13	25	7	16	17	30	13	18	11	15	22	42	13	20	17	25
45	23	31	8	23	27	41	16	21	17	22	58	76	17	33	20	28
60	25	37	7	28	34	65	29	38	200	27	99	100	22	42	26	38
75	24	38	3	25	38	71	20	24	24	32	60	99	25	47	22	35
90	26	39	5	22	51	75	16	20	20	33	61	59	29	47	18	32

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