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A facile solvent free microwave induced synthesis of chlorine containing pyrazoline and Isoxazoline derivatives and their phytotic impact on some flowering plants and antimicrobial activity

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ABSTRACT

Eight New chlorine containing 4-Aroyl/Alkoyl-Δ^2-pyrazolines and isoxazolines have been synthesized with 80-85% yield by a microwave promoted solvent-free condensation of 3-aroyl/alkoylflavanones 5a-d respectively with phenylhydrazine hydrochloride and hydroxylaminehydrochloride over potassium carbonate The work-up is simple and involves treatment with ice-cold water. A considerable increase in the reaction rate has been observed, with better yields.

Key words: Pyrazolines, Isoxazolines solid-phase synthesis, condensation flavanones, microwaves effect.

INTRODUCTION

Pyrazolines and isoxazolines have been reported to show a broad spectrum of biological activities including antibacterial[1], antifungal[2], anti-inflammatory[3] and anti-depressant[4]. The pyrazoline function is quite stable and inspired chemists to utilize this stable fragment in bio-active moieties to synthesis new compounds possessing biological activities and the presence of chloride in the molecules at strategic positions alters the activity. This prompted us to synthesis various substituted pyrazolines and isoxazolines derivatives using the microwave – assisted method. The most straight forward protocol for the synthesis of 4-aroyl/alkoyl-Δ^2-pyrazolines 6a-d and isoxazolines 7a-d involves the one-pot condensation of flavanones 5a-d with phenylhydrazinehydrochloride and hydroxylamine hydrochloride over potassium carbonate respectively under microwave irradiation (MWI). However, the combination of solvents, strong bases and long reaction time period makes this method environmentally hazardous. Thus, a simple, general and efficient procedure for the synthesis of this important heterocyclic system is required. Furthermore there is no report on the synthesis of 4-alkoyl/aroyl-Δ^2-pyrazolines and isoxazolines from flavanones under microwave irradiation (MWI). Therefore, the development of new methods that lead to convenient procedures and better yields are of interest.

In the last two years microwave-induced organic reaction enhancement (MORE) ,chemistry has gained popularity as a non-conventional technique for rapid organic synthesis[5] and many researchers have described accelerated organic reactions, and a large number of papers have appeared proving the synthetic utility of MORE chemistry in routine organic synthesis[6-7]. It can be termed as 'e-chemistry' because it is easy, effective, economical and eco-friendly and is believed to be a step towards green chemistry.

Under the frame-work of "Green chemistry" we have developed an environmentally begin solvent free approach for the synthesis of pyrazolines and isoxazoline. This permitted the elimination of solvents and strong minerals bases in solution[8]. Further attraction of this method is that it permits reaction in open vessels (thus avoiding the risk of high pressure developing) and synthesis on preparative scales[9]. In view of the above and in continuation to our earlier work on the application of MORE[10] chemistry to organic synthesis and the biological importance of pyrazolines, we now report a simple microwave synthesis of Pyrazolines 6a-d and isoxazolines 7a-d from flavanones 5a–d with phenyl-hydrazine hydrochloride and hydroxyl-amine hydroxylaminehydrochloride over potassium carbonate respectively.

The desired flavanones 5a–d were synthesized by reaction of 1,3-propanedione with aromatic and aliphatic aldehydes 4a–d. In a typical case, equimolar quantities of flavanone 5a–d and phenylhydrazine- hydrochloride were absorbed over K_2CO_3 and subjected to MWI, which led to the formation of pyrazolines 6a-d and isoxazoline 7a-d (Scheme–I). The reaction time has been brought down from hours to minutes with improved yields using MWI.

Microwave irradiation facilitates the polarization of the molecules under irradiation causing rapid reaction to occur. This is consistent with the reaction mechanism which involves a polar transition state[11]. Nucleophilic attack on amine on polarized carbonyl function is followed by intramolecular cyclization.

In general the reactions are fast, clean and high yielding

In conclusion we have developed an easy, convenient and efficient synthetic methodology for the synthesis of pyrazoline and isoxazoline derivatives using microwave assisted solid phase technique. The technique used herein can also be further elaborated for the synthesis of other diverse heterocyclic compounds. This rapid and easy technique coupled with solvent free conditions may contribute to the dream of green technology.

RESULTS AND DISCUSSION

The synthetic route for obtaining the final product is presented in Scheme I. The desired compounds were confirmed on the basis of *IR* and *NMR d*ata. Efforts have been made to investigate and analyze the convergence and divergence of the effects of test compounds on the morphology of some short day flowering plants under investigation. When the first comparison of morphological character was made between those of treated and controlled group plants, it was interesting to note that all the treated plants exibited remarkable shoot growth and considerable increase in the number of leaves as compared to the untreated ones.

When all the treated plants were compared among themselves it was distinctly observed that the change which is dominant in *Shewanti* than *Zinia*. In the initial stage vegetative growth is gradually increases but after two weeks it shoots up to a considerable extends in *Shewanti.*

An assay of newly synthesized chlorosubstituted heterocycles revels that, almost all the compounds were active against all the test pathogens. The compounds **6d** and **7d** were most dominant amongst all the test compounds.

However, further investigation and a systematic approach in the light of medical sciences it would certainly proved to be a potential tool in the control of evermutating pathogens.

EXPERIMENTAL

General procedure

Melting points were determined in open capillary tubes and are uncorrected. The purities of the compounds were checked by thin layer chromatography IR spectra were recorded in KBr on a Perkin Elmer spectrum BX-series FT-IR spectrophotometer. NMR spectra were recorded on Bruker PR x 500 MHz. NMR spectrophotometer using TMS as an internal standard and elemental analysis were carried out on a carlo Erba 1108 analyzer. Microwave irradiation were carried out in a OM-25PCE microwave synthesis system with power output of 800 watts.

Flavanones 5a-d and Flavanone derivatives were synthesized by condensing 1-(2'-hydroxy-3',5-dichloro-phenyl-1,3-propanediones with various aldehydes according to the method reported in literature.

Microwave synthesis of pyrazolines

A mixture of the 3-aroyl/alkoylflavanone (0.01mole) and phenylhydrazine hydrochloride (0.02 mole) was dissolved in ethanol (5mL) then K_2CO_3 (4 gm) was added stirred vigorously. After 5 min. solvent was removed under vaccum and the dry-powder to irradiated in the microwave oven for the appropriate time. After the completion of reaction chilled water was added to the reaction mixture. The solid product thus obtained, was filtered dried and crystallized from suitable solvent (Ethanol).

3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-valeroyl-5-(4"-methoxyphenyl)-1-phenyl-Δ²-pyrazoline, 6a

. IR (KBr) – 3306.3, 2929.7, 1647, 1250, 828.7, ^{1}H – (300 MHz, $CDCl_3$ – DMSO), δ (12.71) singlet (Ar-*OH*) 7.84-6.98 (m, 7H, *H*-arom) 3.44 (dd, 1H, H_A) 2.63 (S, 1H, H_B).

Analytical calculated $C_{27}H_{24}O_3N_2Cl_2$ %C= 66.89, % H= 5.08, % N= 5.95 found, calculated %C=66.95, % H = 5.15, % N = 6.

3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-valeroyl-1,5-diphenyl-Δ²-pyrazoline, 6b

3338.6 (OH-Stretching), 2925.4 (CH-streaching), 1781.7 (>C=O stretch.), 1645 (>C=N stretch), 1781.7 to 1645 (C=N-O stretch), 737.5 (C-Cl stretch.), 3.82 (m, 3H, H_A), 2.62 (dd, 2H, H_B), 12.71 (1H,Ar-*H)* 6b, C_{26},H_{22},$O_2N_2C_{l2}$, found %C= 66.10, %H = 6.58% N=5.39 calculated %C= 65.15, % H = 6.63, %N = 5.42%.

3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-anisoyl-5-(4"-methoxyphenyl)-1-phenyl-Δ²-pyrazoline ,6c

3351.4 (OH stretch.), 2987.7 (CH stret.), 1685 (>C=O), 1602.2 (>C=N stretch.) 2839.8 (SP^2CH stretch.), 1260.1 (C-O stretch), 743.9 (s) C-Cl stretch., δ 3.92 (m, 3H, H_A), 2.64 (dd, 2H, H_B), 2.65 (S, 1H, O-CH_3-), 12.74 (s, 1H, Ar-*OH*), 9.82 (m, 4H, Ar-*H*), $C_{30}H_{22}O_4N_2Cl_2$, Found %C = 65.34, %H = 5.1, %N = 4.7, Calculated %C = 65.56, %H = 5.23, % N = 4.78

Physical and analytical data of the synthesized compounds is summarized in the following table.

Table 1: Physical and Analytical characterization data of newly synthesized compounds

Compounds	Mol. Formula	Mol Wt.	Yield %	M.P. °C	Microwave irradiatio-n time
2b	$C_8H_6O_2Cl_2$	205	78	53	6.30 Min
3a	$C_{13}H_{14}O_4Cl_2$	289	75	96	5.25 Min
3b	$C_{16}H_{12}O_4Cl_2$	339	80	98	5 Min
4a	$C_{13}H_{14}O_3Cl_2$	289	80	98	4 Min
4b	$C_{16}H_{12}O_4Cl_2$	339	85	96	4.50 Min
5a	$C_{21}H_{20}O_4Cl_2$	407	70	120	2 Min
5b	$C_{20}H_{17}O_3Cl_2$	376	75	125	3 Min
5c	$C_{24}H_{16}O_5Cl_2$	455	78	107	3.20 Min
5d	$C_{23}H_{15}O_4Cl_2$	426	72	119	1 Min
6a	$C_{27}H_{24}O_3N_2Cl_2$	495	80	155	2 Min
6b	$C_{26}H_{22}O_2N_2Cl_2$	465	75	134	2.25 Min
6c	$C_{30}H_{22}O_4N_2Cl_2$	545	80	105	1.20 Min
6d	$C_{29}H_{20}O_3N_2Cl_2$	515	74	98	1 Min
7a	$C_{21}H_{20}O_4NCl_2$	421	79	158	1.30 Min
7b	$C_{20}H_{19}O_3NCl_2$	392	68	145	1.20 Min
7c	$C_{24}H_{19}O_5NCl_2$	472	83	163	2.2 Min
7d	$C_{22}H_{17}O_4NCl_2$	430	70	140	1.2 Min

Table 2: 3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-valeroyl-5-(4"-methoxyphenyl)-1-phenyl-Δ^2-pyrazoline 6a

Periodicity of the observation (in days)	*Gladiola*				*Zinia*				*Shewanti*				*Dahlia*			
	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	2	3	1	2	6	7	7	10	8	16	10	16	3	6	2	3
30	5	7	3	4	16	18	12	22	25	37	17	26	5	7	8	9
45	8	10	5	5	22	32	22	31	52	65	27	39	12	18	13	19
60	12	15	7	8	29	40	32	43	72	96	38	60	18	26	23	32

C = Control, T = Treated

Table 3: 3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-valeroyl-1,5-diphenyl-Δ^2-pyrazoline 6b

Periodicity of the observation (in days)	*Gladiola*				*Zinia*				*Shewanti*				*Dahlia*			
	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	1	2	2	2	5	8	8	11	12	17	11	19	4	7	4	6
30	3	5	3	4	19	25	14	28	22	33	18	27	6	11	6	12
45	6	7	5	6	24	39	22	33	36	58	31	45	12	15	17	19
60	8	9	7	8	31	43	35	46	54	78	42	68	21	29	27	34

C = Control, T = Treated

Table 4: 3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-anisoyl-5-(4"-methoxyphenyl)-1-phenyl-Δ²-pyrazoline 6c

Periodicity of the observation (in days)	*Gladiola*				*Zinia*				*Shewanti*				*Dahlia*			
	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	2	3	1	3	8	10	7	14	16	22	12	18	5	7	5	6
30	4	5	4	7	11	19	16	23	25	28	22	32	7	11	6	10
45	6	7	8	10	20	26	22	34	44	53	28	46	16	22	16	20
60	8	9	11	13	26	44	32	45	50	65	49	73	23	32	35	50

C = Control, T = Treated

Table 5: 3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-anisoyl-1,5-diphenyl-Δ²-pyrazoline 6d

Periodicity of the observation (in days)	*Gladiola*				*Zinia*				*Shewanti*				*Dahlia*			
	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	3	6	2	3	8	11	5	8	18	26	14	21	4	6	4	4
30	7	9	4	5	14	19	16	24	42	75	32	55	6	14	8	12
45	10	12	6	8	20	25	18	26	83	130	74	108	13	18	16	26
60	13	14	9	10	28	35	35	49	119	178	84	138	22	32	28	39

C = Control, T = Treated

Table 6: 3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-valeroyl-5-(4"-methoxyphenyl)isoxazoline 7a

Periodicity of the observation (in days)	*Gladiola*				*Zinia*				*Shewanti*				*Dahlia*			
	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	3	4	1	2	6	7	7	10	10	16	18	16	4	6	3	5
30	4	7	4	5	17	18	12	22	28	37	19	26	6	7	9	11
45	8	9	5	5	24	32	27	31	55	65	29	39	14	18	13	21
60	11	13	6	7	29	40	35	43	76	96	40	65	19	26	25	32

C = Control, T = Treated

Table 7: 3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-valeroyl-5-phenylisoxazoline 7b

Periodicity of the observation (in days)	*Gladiola*				*Zinia*				*Shewanti*				*Dahlia*			
	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	2	3	2	3	5	8	9	11	11	167	12	19	3	7	5	6
30	5	6	4	6	21	25	13	28	23	34	19	27	9	11	7	12
45	8	8	7	9	27	39	26	33	37	54	35	45	14	15	18	21
60	9	10	9	9	37	43	38	46	58	80	44	68	24	29	22	31

C = Control, T = Treated

Table 8: 3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-anisoyl-5-(4"-methoxyphenyl)isoxazoline 7c

Periodicity of the observation (in days)	*Gladiola*				*Zinia*				*Shewanti*				*Dahlia*			
	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	2	3	2	3	8	10	7	14	16	22	12	18	5	7	5	7
30	4	5	4	6	11	19	16	23	25	28	22	32	7	14	8	10
45	6	7	8	10	23	26	25	34	48	53	28	43	16	22	16	20
60	8	9	11	12	29	44	32	45	56	65	55	73	23	32	29	35

C = Control, T = Treated

Table 9: 3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-anisoyl-5-phenylisoxazoline 7d

Periodicity of the observation (in days)	*Gladiola*				*Zinia*				*Shewanti*				*Dahlia*			
	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	3	6	2	3	8	11	5	8	18	26	14	21	4	6	4	4
30	7	9	5	7	14	20	16	24	42	75	32	55	6	14	8	12
45	11	12	9	10	20	24	21	26	83	130	74	118	14	18	13	26
60	14	14	12	14	28	38	37	49	140	187	88	140	22	33	27	39

C = Control, T = Treated

3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-anisoyl-1,5-diphenyl-Δ²-pyrazoline, 6d

3433.3 (strong OH-Stretching), 2982.1 (CH-streaching in alkane), 1601.0 (>C=O stretch.), 1166.1 to 1260.1 (>C=N stretch), 771.5 (C-Cl stretch.), 3.87 (m, 3H, H_A), 2.65 (dd, 1H, H_B), 2.33 (m, 3H, O-CH_3), 13.30 (S, 1H, Ar-*OH*) 6.91 to 7.46 (m, 16H, Ar-*H*), $C_{29}H_{20}O_3N_2C_{l2}$, calculated %C = 65.43 , % H = 5.32, %N = 5.94, found %C = 64.12, %H = 5.21, % N=5.80.

Microwave synthesis of Isoxazolines

A mixture of 3-aroyl/alk-oylflavanone (0.01 mole) and hydroxylamine hydrochloride (0.02 mole) was dissolved in ethanol, (5mL) then K_2CO_3 (4 gm) was added and stirred vigorously. After 5 minutes the solvent was removed under vaccum and the dry-powder was irradiated in a microwave oven for appropriate time. After the completion of reaction chilled water is added the reaction mixture. The solid product thus obtained, was filtered dried and crystallized from suitable solvent.

3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-valeroyl-5-(4"-methoxyphenyl)Isoxa- zolines ,7a

IR (KBr) – 3410.2 (OH-stretch.), 2932.1, 1684 (>C=O), 1306.3 (C=O stretch. In phenyl), 1513.4 (C=N), 1439.5 – 1513.4 (C=C), 832.3 (C-Cl), ^{1}H PMR – 9.84 (S,1H), 8.07 to 7.83 (m, Ar-*H*), 3.82 (S, H_A), 2.65 (S, H_B). $C_{21}H_{20}O_4N_2Cl_2$ C-66.89%, H- 5.08%, N- 5.95 found, calculated %C-66.95, % H – 5.25, % N = 6.1.

3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-valeroyl-5-phenylisoxazoline, 7b

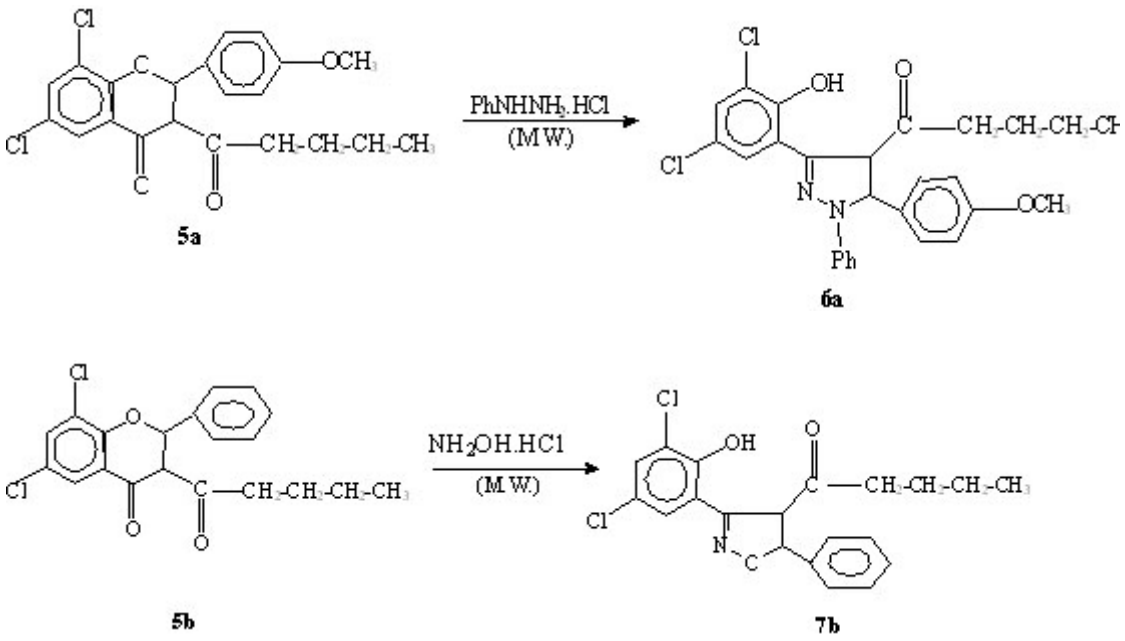
3371.5 (wb) (strong OH-Stretching), 2969.3 (CH-streach. in alkane), 1727.1 (>C=O stretch.), 1646.9 (>C=N stretch),1365.3 (C=O in phenyl), 1435.9 to 1305.7 (C=C stretch), 788.4 (C-Cl stretch.), ^{1}H PMR – 12.71 (S, Ar-O*H*), 7.63 (m, 7H, Ar-*H*), 3.5 (S,1H, H_A), 2.64 (S,1H, H_B), $C_{20}H_{19}O_3NCl_2$, Found %C = 65.10, %H = 6.58, % N=5.39. Calculated %C = 65.15, % H = 6.63, %N = 5.42%.

3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-anisoyl-5-(4"-methoxyphenyl)isoxaz- oline.7c

3374.1 (Strong- OH stretch.), 2981.7 (CH stret.in alkane), 1922.3 (>C=O), 1576 (>C=N stretch.), 1302.6 (C=O stretch. in phenyl), 1427.4 (C=C stretch.), 772.3 (C-Cl stretch.), ^{1}H PMR - 12.72 (S, Ar-*OH*), 7.64 to 7.26 (m,10H, Ar-*H*), 3.90-3.75 (m,2H, H_A), 2.65 (dd, H_B), $C_{24}H_{19}O_5NCl_2$ Found %C = 62.68, %H = 5.08, %N = 3.4. Calculated %C = 63.71, %H = 5.22, % N = 3.6

3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-anisoyl-5-phenylisoxazoline ,7d

3373.1 (OH-Stretching), 2982.1 (CH-streaching in alkane), 1925.5 to 1686.2 (>C=O



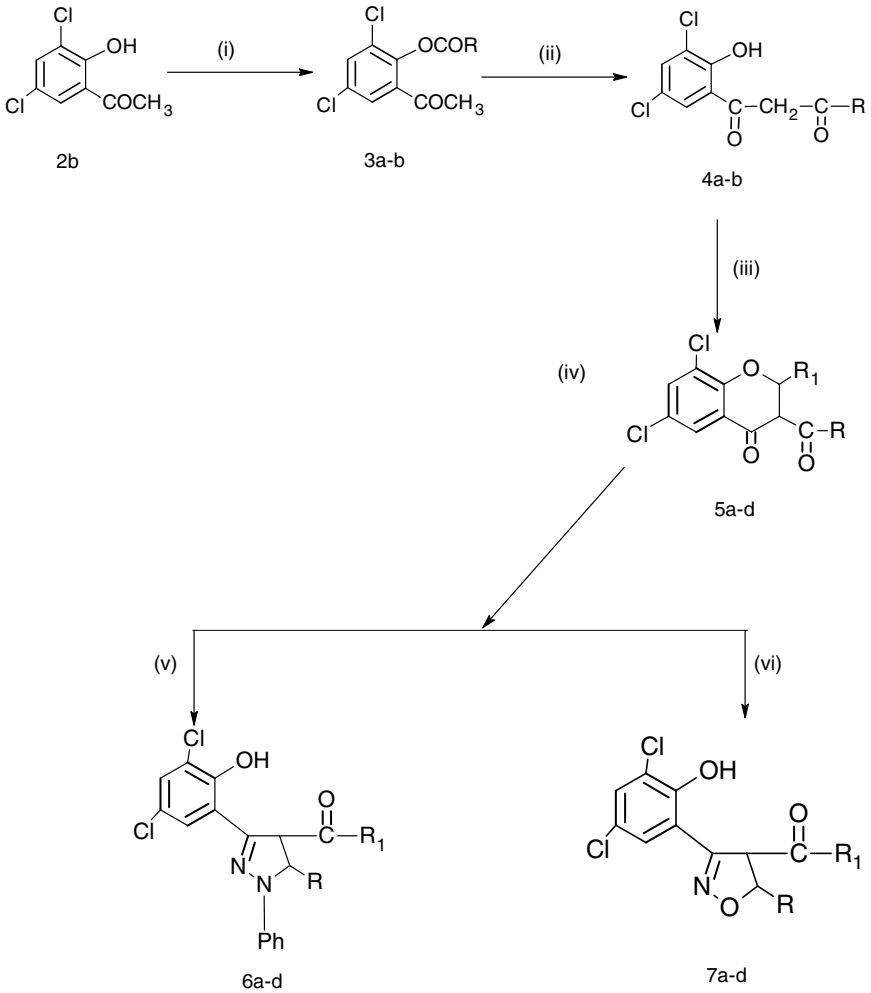
5a **6a** **5b** **7b**

stretch.), 1577.5 (>C=N stretch), 1686.2 to 16037 (C=N-O), 1427.8- 1516.3 (C=C stretch.), 772.7 (C-Cl stretch.), ^{1}H PMR – 8.08 (S, Ar-*OH*), 7.36 to 6.93 (m, 11H, Ar-*H*), 3.88 (S,H_A), 2.34 dd (2H, H_B), $C_{22}H_{17}O_4NC_{l2}$, Found %C = 61.68, %H = 5.18, % N= 3.46. Calculated %C = 62.71, % H = 5.24, %N = 3.62.

Growth promoting hormonal effect of newly synthesized pyrazolines an isoxazolines on some flowering plants

Pregerminated seeds of flowering plants viz. *Gladiola (Gladiolous Iridiaceae), Zinia (Zinia elegans), Shewanti (Chrysanthamum), Dahlia (Dahlia Varabilis)* were treated with the taste compound. The beds of black cotton soil 2.5 x 2.5 meter size were prepared on an open field.

The seeds of all four species under examination were sowed in these beds separately by a conventional method. Beds were irrigated as



2b 3a-b 4a-b 5a-d 6a-d 7a-d

Where,

R

a & c = $C_6H_5OCH_3$

b & d = CH_3-CH_2-CH_2-CH_2

R1 (a & b) = CH_3-CH_2-CH_2-CH_2

c & d= $C_6H_5OCH_3$

ii] KOH+MW

iii] [Valeraldehyde, Anisaldehyde] +MW

iv] Ph.NH.NH_2.HCl + MW

v] NH_2OH.HCl + MW

i] 2a=C_6H_5COCl, 10% NaOH.2b= Valeric acid & Anisic acid.

Scheme 1:

and when required by tap water. The plants of each bed were divided into to two groups (A) and (B). The group (A) plants were kept unsprayed and termed as control group whereas the plants from group (B) were spreads periodically designated as a treated group.

The spraying solution of newly synthesized chlorosubstituted heterocyclic compounds pyrazolines and isoxazolines have prepared in dioxane (0.01 dilution) separately and sprayed at fortnightly intervals 15, 30, 45 and 60 days on flowering plants. The plants were carefully examined and number of leaves and heights of their shoots were recorded. The data obtained subjected to analysis of growth parameters. When the first comparison of morphological character was made between those of treated and controlled group plants, it was interesting to note that all the treated plants exhibited a remarkable shoot growth and a considerable increase in the number of leaves as compared to the untreated ones. When all the treated plants were compared among themselves, it was distinctly observed that, the change which is dominant in *Shevanti* than *Ziniya*. In the first interval of 15 to 30 days. The growth greadually increases but after 30 days it shows a considerable growth (Table II-IX).

Table 10: Antibacterial activities of test compounds

S. No.	Test Compounds	Zone of inhibition (mm)			
		E. coli	***K. pneumoniae***	***S. aureus***	***B. subtilis***
1	3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-valeroyl-5-(4"-methoxyphenyl)-1-phenyl-Δ^2-pyrazoline 6a	13	17	15	14
2	3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-valeroyl-1,5-diphenyl-D^2-pyrazoline 6b	27	26	26	25
3	3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-anisoyl-5-(4"-methoxy phenyl)-1-phenyl-Δ^2-pyrazoline 6c	26	27	22	22
4	3-(2-Hydroxy-3,5-dichlorophenyl)-4-anisoyl-1,5-diphenyl-Δ^2-pyrazoline 6d	29	27	28	28
5	3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-valeroyl-5-(4"-methoxyphenyl)isoxazoline 7a	12	16	14	13
6	3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-valeroyl-5-phenylisoxazoline 7b	24	22	22	21
7	3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-anisoyl-5-(4"-methoxyphenyl)isoxazoline 7c	25	26	21	21
8	3-(2'-Hydroxy-3',5'-dichlorophenyl)-4-anisoyl-5-phenylisoxazoline 7d	27	26	26	27

Antimicrobial activity

The cultures of plant pathogens namely Viz: *E.coli, K. pneumoniae, S.aureus, B. subtilis* were treated with the taste compound.

The punch discs of 6.25 m.m. diameter of *Whatman filter paper No. 1* were prepared and dispensed in the batches of 100 each in screw capped bottles. These were sterilized by dry heat at 140^{O}Cfor 60 minutes. The solutions of 0.01 mole dilution of test compounds were prepared in dioxane solvent separately. The discs were soaked, assuming that each disc will contain approximately 0.01 mL of test solution.

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