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Synthesis and study of 2-hydroxy substituted Chalcone dibromide effects on different crop plant growth

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ABSTRACT

The synthesized 3-bromo-5-chloro-2-hydroxyacetophenone on condensation with anisaldehyde and benzaldehyde gives corresponding 2-hydroxy substituted chalcone. On bromination, 2-hydroxy substituted chalcone gives 5-chloro-2-hydroxy chalcone dibromide, 5-chloro-2-hydroxy -4-methoxy chalcone dibromide, 3-bromo-5-chloro-2-hydroxy chalcone dibromide and 3-bromo-5-chloro-2-hydroxy-4-methoxy chalcone dibromide respectively. The structure of ligands was elucidated on the basis of molecular weight, elemental analysis and spectral data.

Keywords: Acetophenone, substituted Chalcone dibromide.

INTRODUCTION

Chalcone have been associated with diverse biological activities, e.g. cardiovascular [1], antiviral [2], anticancer [3] and industrial application [4]. Synthesis and antimicrobial activity of some novel chalcone and its derivative were studied by Kaithwal et al [5]. Shridhar et al [6] have been synthesized and studied antimicrobial and anti-inflammatory activity of chalcone 1-(2', 5'-dimethyl-3-furyl)-3-(aryl)-2-propene-1-one. Utale et al [7] reported chalcone dibromide by the reaction of bromine in 25% w/v acetic acid with 3-substituted-2-hydroxy-5-chloro chalcone. Khadsan and Doshi [8] synthesized the α , β -acetophenone dibromide from acrylophenones by bromination using acetic acid. Maurya [9] reported the growth promoting effects of pyrazolines and isoxazoline on agriculture crop plants. Substituted isoxazolines and pyrazolines in 70% dioxane- water mixture and effect on seed germination were studied by Meshram et al [10]. Ramteke et al [11] have been studied the effects of chlorosubstituted pyrazoles and their complexes on spinach (*Spinacia oleracea* L.) at different pH. Synthesis and growth promoting effects of chloro-substituted heterocycles on agricultural crop plants have been studied by Parhate et al [12].

MATERIALS AND METHODS

All chemicals used were of analytical grade and were used without purification. 2-hydroxyacetophenone and ethylenediamine were obtained from Merck and S. D. fine chemicals. 5-chloro-2-hydroxyacetophenone was prepared according to the literature method [13]. The structure of ligands was elucidated on the basis of molecular weight, elemental analysis and spectral data. Physical and analytical data of synthesized compounds are summarized in Table 1.

Preparation of 3-bromo-5-chloro-2-hydroxy acetophenone

5-chloro-2-hydroxyacetophenone (0.01M, 1.70 gm) was dissolved in glacial acetic acid (10 mL). 25% bromine in acetic acid solution (7 mL) was added drop wise with continuous stirring. The product started separating when the reaction was complete. The product was filtered, washed with water and crystallized from ethanol.

Preparation of 2-hydroxy substituted chalcone

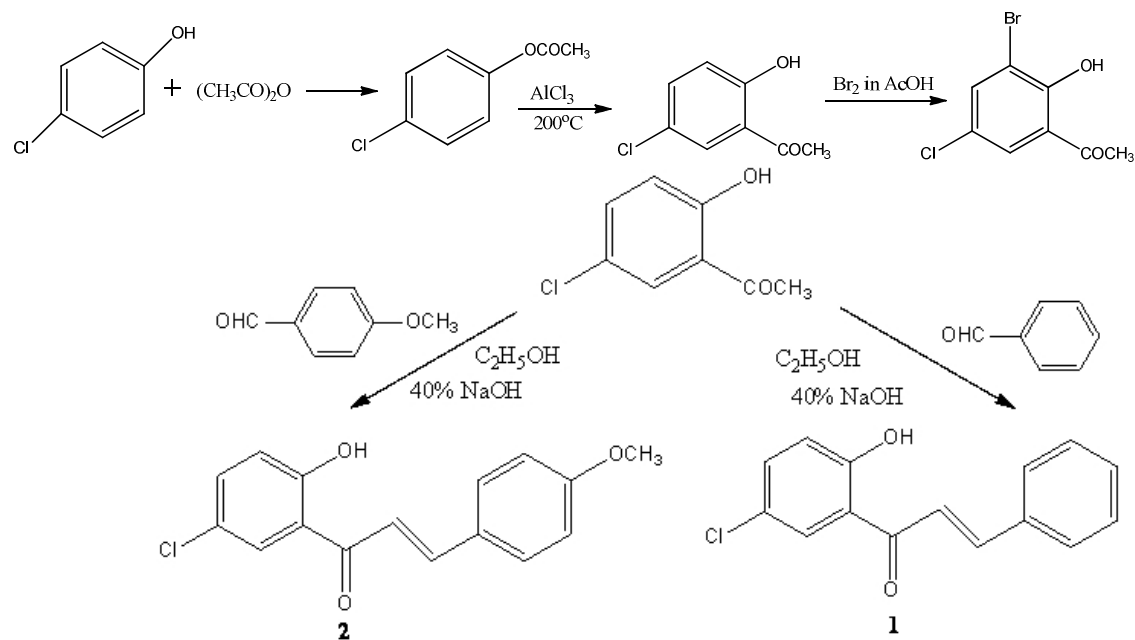
The 2-hydroxy substituted acetophenone with anisaldehyde and benzaldehyde were dissolved in ethanol and the reaction mixture was brought to boiling in presence of aq. NaOH with constant stirring. The solution was kept overnight. Obtained sodium salt was decomposed by aq. HCl. A yellow colored solid product obtained was crystallized from ethanol to get 2-hydroxy substituted chalcone.

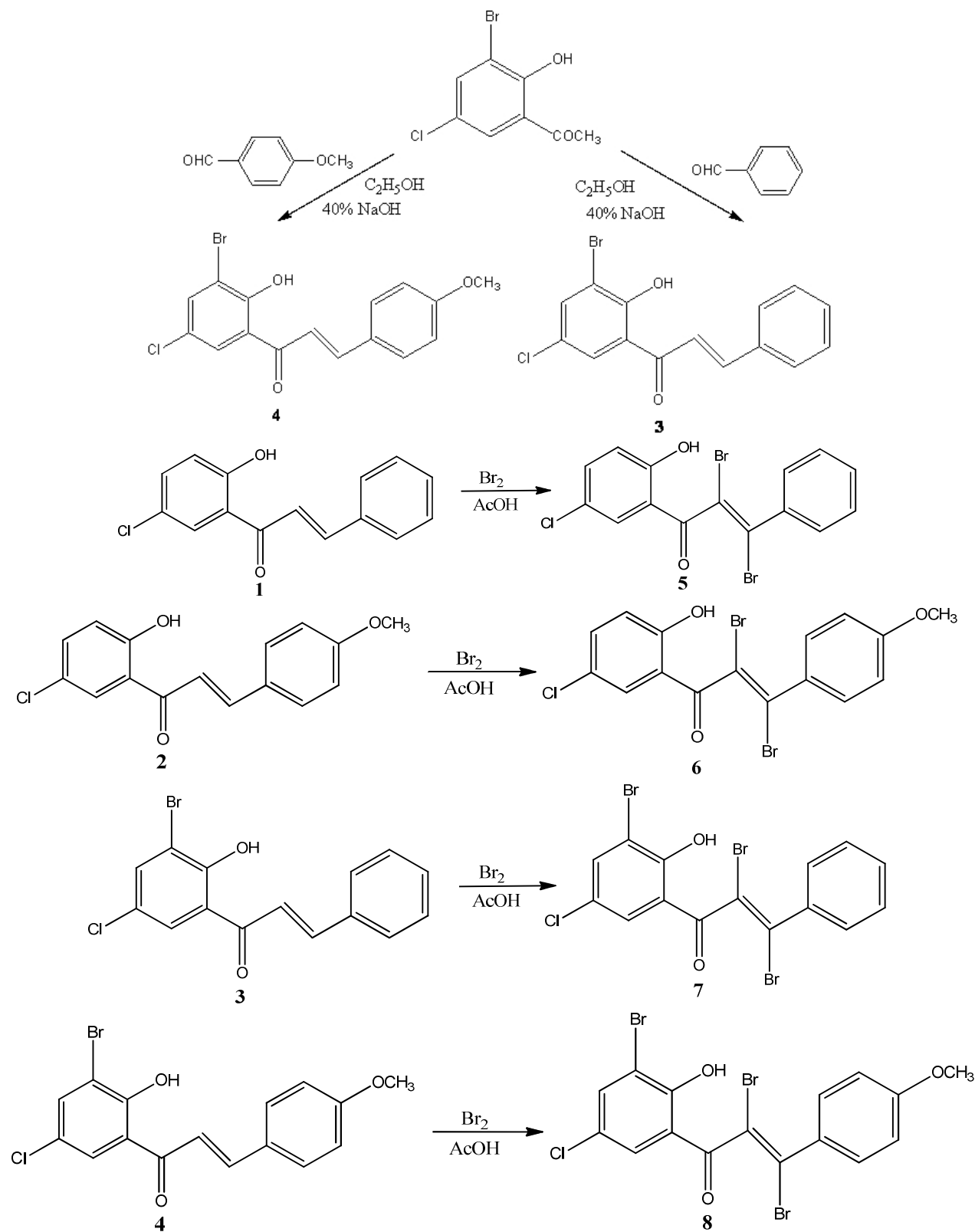
- i) 5-chloro-2-hydroxy chalcone (**1**).
- ii) 5-chloro-2-hydroxy-4-methoxy chalcone (**2**).
- iii) 3-bromo-5-chloro-2-hydroxy chalcone (**3**).
- iv) 3-bromo-5-chloro-2-hydroxy-4-methoxy chalcone (**4**).

Preparation of 2-hydroxy substituted chalcone dibromide

The 2-hydroxy substituted chalcone was dissolved in boiled glacial acetic acid. A solution of bromine in acetic acid was added to this solution with constant stirring. The product of 2-hydroxy substituted chalcone dibromide was filtered and washed with alcohol followed by petroleum ether.

- i) 5-chloro-2-hydroxy chalcone dibromide (**5**).
- ii) 5-chloro-2-hydroxy-4-methoxy chalcone dibromide (**6**).
- iii) 3-bromo-5-chloro-2-hydroxy chalcone dibromide (**7**).
- iv) 3-bromo-5-chloro-2-hydroxy-4-methoxy chalcone dibromide (**8**).

REACTION MECHANISM



GROWTH PROMOTING EFFECT

The bed of black cotton soil with fairly good drainage was prepared on an open field. The seeds of three species like soya bean, groundnut and chickpea 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 where 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 synthesized chalcone dibromide was

prepared in 1, 4-dioxane (0.01 M) separately and sprayed at fortnightly intervals (15, 30, 45, 60 and 75 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 and 75 days after sowing. The plants were carefully examined and height, number of functional leaves per plant, number of pods per plant and seed yields per hectare was recorded.

Table 1 Analytical and Physical data of synthesized compounds

Compound	Molecular Formula	% of Yield	m.p. (°C)	Found/ Calcd.				
				C	H	O	Cl	Br
5 (L ₁)	C ₁₅ H ₁₁ O ₂ ClBr ₂	80	182	43.38 (43.03)	2.61 (2.63)	7.67 (7.65)	8.42 (8.47)	38.82 (38.20)
6 (L ₂)	C ₁₆ H ₁₃ O ₃ ClBr ₂	72	148	43.06 (42.83)	2.83 (2.90)	10.78 (10.71)	7.85 (7.91)	35.52 (35.65)
7 (L ₃)	C ₁₅ H ₁₀ O ₂ ClBr ₃	75	118	36.76 (36.42)	1.99 (2.06)	6.52 (6.44)	7.10 (7.13)	48.09 (48.21)
8 (L ₄)	C ₁₆ H ₁₂ O ₃ ClBr ₃	68	138	36.82 (36.20)	2.22 (2.28)	10.01 (9.90)	6.77 (6.72)	46.04 (45.47)

RESULTS AND DISCUSSION

When the comparison of morphological character [14-17] was made between those of treated and controlled group plants, it was interesting to note that all treated plants exhibited remarkable growth and consideration increases in height, number of leaves, number of pods per plant and yield as compared to the untreated ones Table 2-6.

Soyabean

In Soyabean crop, L₄ ligand shows the maximum height, highest number of leaves, maximum number of pods per plant and maximum yield. But control plant shows minimum value of results than treated plant. The trend of ligands as follow;

$$L_4 > L_3 > L_1 > L_2 > \text{Control}$$

Groundnut

In Groundnut crop, L₃ ligand shows the maximum height as compared to other ligands. Maximum number of leaves found in Ligand L₂. L₄ ligand shows maximum number of pods per plant and yield than other ligand. But the control plant shows minimum values as compared to other all treated plants.

Chickpea

In the crop Chickpea, L₃ ligand shows the maximum number of branches, number of pods per plant and yield at 30, 60 and 75 days as compared to other ligands. The activity trend of ligand as follow;

$$L_3 > L_1 > L_2 > L_4 > \text{Control}$$

Table 2 Effect of Synthesized L₁ on height and no of leaves of plants

Test Compd	Periodicity of the obs days	Soybean				Groundnut				Chickpea			
		Height		No of Leaves		Height		No of Leaves		Height		No of Leaves	
		C	T	C	T	C	T	C	T	C	T	C	T
L ₁	15	12.47	15.0	2.00	2.00	6.9	7.9	9.33	14.6	-	-	-	-
	30	24.27	34.4	5.33	9.00	12.3	12.0	30.3	26.0	18.1	21.5	2.0	2.6
	45	27.57	37.9	10.0	12.0	29.0	32.2	34.6	31.0	-	-	-	-
	60	29.43	40.17	14.3	13.0	40.0	41.5	38.6	38.6	26.6	33.8	4.0	5.0
	75	45.67	53.3	9.67	7.0	47.00	61.3	42.0	42.3	27.5	37.6	4.3	6.3

Table 3 Effect of Synthesized L₂ on height and no of leaves of plants

Test Compd	Periodicity of the obs days	Soybean				Groundnut				Chickpea			
		Height		No of Leaves		Height		No of Leaves		Height		No of Leaves	
		C	T	C	T	C	T	C	T	C	T	C	T
L ₂	15	12.47	12.97	2.00	2.67	6.9	8.2	9.33	14.0	-	-	-	-
	30	24.27	34.93	5.33	11.67	12.3	14.6	30.3	32.0	18.1	21.1	2.0	2.3
	45	27.57	36.83	10.0	14.33	29.0	25.4	34.6	35.3	-	-	-	-
	60	29.43	37.97	14.3	15.67	40.03	35.9	38.6	40.3	26.6	33.6	4.0	5.0
	75	45.67	65.00	9.67	10.67	47.00	51.0	42.0	44.0	27.5	37.1	4.3	6.6

Table 4 Effect of Synthesized L₃ on height and no of leaves of plants.

Test Compd	Periodicity of the obs days	Soybean				Groundnut				Chickpea			
		Height		No of Leaves		Height		No of Leaves		Height		No of Leaves	
		C	T	C	T	C	T	C	T	C	T	C	T
L ₃	15	12.47	13.53	2.00	2.0	6.9	8.63	9.33	10.6	-	-	-	-
	30	24.27	35.2	5.33	11.0	12.3	14.5	30.3	32.3	18.1	22.2	2.0	2.3
	45	27.57	39.2	10.0	13.0	29.0	29.4	34.6	35.3	-	-	-	-
	60	29.43	41.6	14.3	14.3	40.0	39.6	38.6	41.0	26.6	34.2	4.0	5.0
	75	45.67	65.00	9.67	8.00	47.0	54.0	42.0	43.6	27.5	38.7	4.3	5.3

Table 5 Effect of Synthesized L₄ on height and no of leaves of plants

Test Compd	Periodicity of the obs days	Soybean				Groundnut				Chickpea			
		Height		No of Leaves		Height		No of Leaves		Height		No of Leaves	
		C	T	C	T	C	T	C	T	C	T	C	T
L ₄	15	12.47	14.07	2.00	2.6	6.9	7.9	9.33	12.6	-	-	-	-
	30	24.27	37.93	5.33	10.3	12.3	13.9	30.3	25.3	18.1	21.1	2.0	2.6
	45	27.57	41.07	10.0	13.3	29.0	36.8	34.6	33.0	-	-	-	-
	60	29.43	43.17	14.3	15.6	40.0	48.1	38.6	39.0	26.6	33.0	4.0	4.6
	75	45.67	58.3	9.67	11.0	47.00	59.6	42.0	42.6	27.5	36.0	4.3	6.0

Table 6 Effect of Synthesized Ligands on no. of pods per plant at harvest and yield (q/ha) of plants.

Plant	Treatment	No. of pods per plant at harvest	Yield (q/ha)
Soybean	Control	14.27	18.10
	Solvent	16.13	20.38
	L ₁	21.53	18.13
	L ₂	20.40	17.40
	L ₃	22.13	20.44
	L ₄	16.07	20.85
Groundnut	Control	11	21.30
	Solvent	15	22.58
	L ₁	12	22.37
	L ₂	12	22.40
	L ₃	13	22.73
	L ₄	13	23.20
Chickpea	Control	14.00	12.45
	Solvent	21.00	16.68
	L ₁	23.33	19.25
	L ₂	20.00	17.20
	L ₃	22.67	19.25
	L ₄	22.33	18.99

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