International Journal of Basic and Applied Chemical Sciences ISSN: 2277-2073 (Online)
An Open Access, Online International Journal Available at http://www.cibtech.org/jcs.htm
2016 Vol. 6(3) July-September, pp.5-21/Badnakhe and Rajput
Research Article

SYNTHESIS AND STUDY OF SUBSTITUTED 1,3-THIAZOLES AND THEIR NANOPARTICLES ON PHYTOTIC GROWTH OF SOME VEGETABLE CROPS

***Chhaya D. Badnakhe[1] and P. R. Rajput[2]**
[1]*Department of Chemistry, Dr. Manorama and Prof. H.S. Pundkar, Arts, Commerce and Science College, Balapur, Dist. Akola*
[2]*Department of Chemistry, Vidyabharti Mahavidyalaya, Amravati-444604, India*
**Author for Correspondence*

ABSTRACT
The synthesis, spectral analysis and biological activities of 5-phenyl-2-hydroxy-chlorosubstituted-2-amino-1,3 thiazoles have been carried out. In this case 5-(2'-hydroxy-3',5'-dichlorophenyl)-4-(4"-nitrobenzoyl)-2-amine-1,3-thiazole (D), 5-(2'-hydroxy-3',5'-dichlorophenyl)-4-(4"-nitrobenzoyl)-2-phenyl-amino-1,3-thiazole (E), and 5-(2'-hydroxy-3',5'-dichlorophenyl)-4-(4"-nitrobenzoyl)-2-diphenyl-amino-1,3-thiazole (F) have been screened. The compounds D, E and F were synthesized from 1-(2'-hydroxy-3',5'-dichlorophenyl)-2-bromo-3-(4"-nitrophenyl)-1,3 propanedione (a_4) by the action of thiourea, phenylthiourea, diphenylthiourea. The nanoparticles of the compounds D, E and F have been prepared by using ultrasonic technique. The titled compounds and their nanoparticles were screened for growth promoting activity on some vegetable crop plants viz.. *Momordica charantia-L-Bitter guard (Karela), Lagneria siceraria-snake guard (Lavki), Luffa cylindrica L-sponge guard (Gilke) and Benincasa hispida-Pumpkin (Kohle).*

Keywords: *Chalcone, Thiazole, Thiourea, Phenyl Thiourea, Diphenyl Thiourea, Growth Promoting Activities*

INTRODUCTION
Heterocyclic nucleus plays an important role in medicinal chemistry and it is a key template for the growth of various therapeutic agents. Thiazole is a heterocyclic compound featuring both a nitrogen atom and sulfur atom as part of the aromatic five-membered ring. Thiazoles and related compounds are called 1,3-azoles (nitrogen and one other hetero atom in a five-membered ring). They are isomeric with the 1,2-azoles, the nitrogen and sulphur containing compound being called isothiazoles. Thiazoles are found naturally in the essential vitamins. Molecules that possess sulfur atoms are important in living organisms. The researchers Patterson and Capell (1940), Pullman A and Metzger (1948), Schwarz (1945), Alajarin *et al.,* (2006), Kumar and Kumar (2011-12), Patton *et al.,* (2009) have reported the synthesis of several thiazoles and also their potent biological activities such as antimicrobial (Jain *et al.,* 2011), antibacterial (Kaspady *et al.,* 2009; Sanz-Cervera *et al.,* 2009; Patel and Mehta, 2006; Shakeel *et al.,* 2010), antifungal (Kopnarr *et al.,* 2004; Logu *et al.,* 2005), fungicidal (Liu *et al.,* 2004) and insecticidal agent (Pattanaik *et al.,* 1998). Chalcones and their analogues having α, β-unsaturated carbonyl system are very versatile substrates for the evolution of various reactions and physiologically active compounds.
In the present study, various 5-phenyl-2-hydroxy-chlorosubstituted-2-amino-1,3 thiazoles have been synthesized from 1,3 propanediones by using thiourea, phenyl thiourea and diphenyl thiourea. The synthesized compounds along with their nanoparticles were evaluated for their growth promoting activity on some vegetable crop plants viz. *Momordica charantia-L-Bitter guard (Karela), Lagneria siceraria-snake guard (Lavki), Luffa cylindrica L-sponge guard (Gilke) and Benincasa hispida-Pumpkin (Kohle).*

MATERIALS AND METHODS
All the glasswares used in the present work were of pyrex quality. Melting points were determined in hot paraffin bath and are uncorrected. The purity of compounds was monitored on silica gel coated TLC plate. IR spectra were recorded on Perkin-Elmer spectrophotometer in KBr pelletes, H^1 NMR spectra on

spectrophotometer in $CDCl_3$ with TMS as internal standard. UV spectra were recorded in nujol medium. The analytical data of the titled compounds was highly satisfactory. All the chemicals used were of analytical grade. All the solvents used were purified by standard methods. Physical characterisation data of all the compounds is given in Table 1.

2'-Hydroxy 3',5'-Dichloroacetophenone:

2-Hydroxy-5-chloroacetophenone was dissolved in acetic acid (5 ml), Sodium acetate (3g) was added to the reaction mixture and then chlorine in acetic acid reagent (40 ml; 7.5 w/v) was added dropwise with stirring. The temperature of the reaction mixture was maintained below 20^0C. The mixture was allowed to stand for 30 minutes. It was poured into cold water with stirring. A pale yellow solid then obtained was filtered, dried and crystallized from ethanol to get the compound 2'-hydroxy 3',5'-dichloroacetophenone.

Preparation of 2''-hydroxy-3'',5''-dichlorophenyl-4-(4'''-nitrophenyl) chalcone (a):

To the boiling solution of the 2-hydroxy-3,5-dichloroacetophenone (0.01 mol) and p-nitrobenzaldehyde (0.01 mol) in ethanol (20 ml) a 40% solution of NaOH was added gradually. The reaction mixture was stirred mechanically at room temperature for 1 hour and kept steady for 6 to 8 hours, followed by decomposition with ice cold HCl (1:1). The yellow granules thus obtained were filtered, washed with 10% $NaHCO_3$ solution and then crystallized from ethanol-acetic acid mixture to obtain the compound (a).

Preparation of 1-(2''-hydroxy-3'',5''-dichlorophenyl)-2,3-dibromo-3-(4'''-nitrophenyl)-propan-1-one (a_1):

2'-Hydroxy-3',5'-dichlorophenyl-4-(4"-nitrophenyl) chalcone (a) (0.001 M) was suspended in bromine–glacial acetic acid reagent (25% w/v) (6.4 ml).

The reagent was added dropwise with constant stirring and the reaction mixture was kept at room temperature for about 30 minutes. The solid product, thus separated, was filtered and washed with a little petroleum ether to get the compound (a_1).

Preparation of 2-(4'''-nitrophenyl)-6,8-dichloroflavone (a_2):

1-(2'-Hydroxy-3',5'-dichlorophenyl)-2,3-dibromo-3-(4"-nitrophenyl)-propan-1-one (a_1) (0.01 mol) was dissolved in ethanol (25ml). To this, aqueous KOH solution (25 ml) was added. The reaction mixture was refluxed for 1 hour, cooled and diluted with water. The product thus separated was filtered and crystallized from ethanol to get the compound (a_2).

Preparation of 1-(2''-hydroxy-3'',5''-dichlorophenyl)-3-(4'''-nitrophenyl)-1,3-propandione (a_3):

2-(4"-Nitrophenyl)-6,8-dichloroflavone (a_2) (0.01 mol) was dissolved in ethanol (25ml). To this, aqueous solution of HCl (25 ml) was added. The reaction mixture was then refluxed for 1 hour, cooled, and diluted with water. The product, thus separated, was filtered, and crystallized from ethanol to get the compound (a_3).

Preparation of 1-(2''-hydroxy-3'',5''-dichlorophenyl)-2-bromo-3-(4'''-nitrophenyl)-1,3 propanedione (a_4):

1-(2'-Hydroxy-3',5'-dichlorophenyl)-3-(4"-nitrophenyl)-1,3-propandione (a_3) (0.01 mol) was dissolved in a mixture of ethanol and dioxane. To this, calculated amount of liquid bromine was added. The product was not separated even after standing for one hour. It was then diluted with water, washed with water several times and extracted with ether. The solvent was removed under reduced pressure to get the white solid of the compound (a_4).

Preparation of 5-(2''-hydroxy-3'',5''-dichlorophenyl)-4-(4'''-nitrobenzoyl)-2-amine-1,3-thiazole (D):

1-(2'-Hydroxy-3',5'-dichlorophenyl)-2-bromo-3-(4"-nitrophenyl)-1,3-propandione (a_4) (0.01 mol) and thiourea (0.01 mol) was dissolved in ethanol (25 ml). To this, aqueous KOH solution (0.02 mol) was added. The reaction mixture was then refluxed for 3 hours, cooled, diluted with water and acidified with conc. HCl. The product thus separated was filtered and crystallized from ethanol to get the compound (D).

Preparation of 5-(2''-hydroxy-3'',5''-dichlorophenyl)-4-(4'''-nitrobenzoyl)-2-phenyl- amino-1,3-thiazole (E):

1-(2'-Hydroxy-3',5'-dichlorophenyl)-2-bromo-3-(4"-nitrophenyl)-1,3-propandione (a_4) (0.01 mol) and phenyl thiourea (0.01 mol) were dissolved in ethanol. To this, aqueous KOH solution (0.02 mol) was added.

The reaction mixture was refluxed for 3 hours, cooled, diluted with water and acidified with conc. HCl. The product, thus separated, was filtered and crystallized from ethanol to get the compound (E).

Preparation of 5-(2'-hydroxy-3',5'-dichlorophenyl)-4-(4''-nitrobenzoyl)-2-diphenyl-amino-1,3-thiazole (F):

1-(2'-Hydroxy-3',5'-dichlorophenyl)-2-bromo-3-(4''-nitrophenyl)-1,3-propandione (a_4) (0.01 mol) and diphenyl thiourea (0.01 mol) were dissolved in ethanol. To this aqueous solution of KOH (0.02 mol) was added. The reaction mixture was then refluxed for three hours, cooled, diluted with water and acidified with conc. HCl. The product, thus separated, was filtered and crystallized from ethanol to get the compound (F).

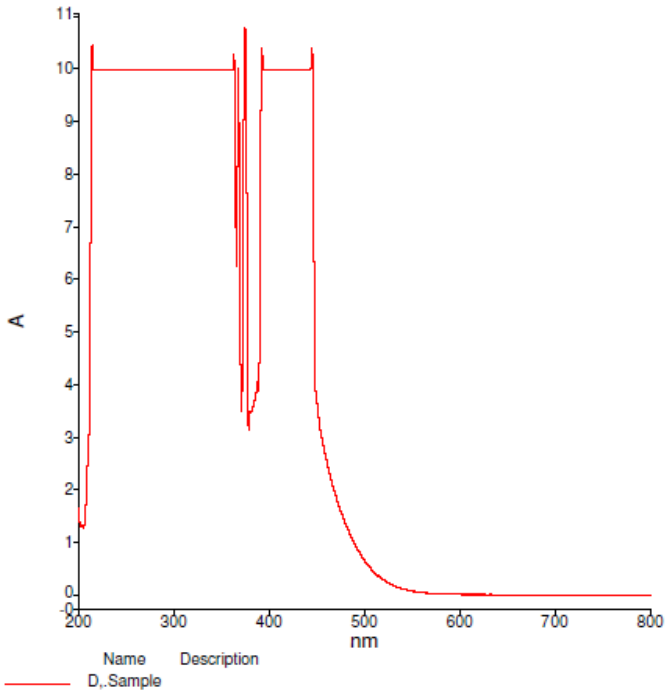
The newly synthesized compounds were characterized on the basis of elemental analysis, molecular determination, UV, IR, NMR. spectral data.

The UV, IR, and NMR Spectral Data:

Compound (D):

UV: Spectrum No. 1

The UV-Vis spectrum of the compound (D) reported in dioxane showed λ_{max} value 475 nm corresponding to n→π* transition.



Spectrum No. 1

IR (KBr): Spectrum No. 2

3335.23 cm^{-1}(-OH phenolic), 2923.23 cm^{-1} (aliphatic -C-H stretching), 3074.22 cm^{-1} (aromatic -C-H stretching), 3788.41 cm^{-1} (-N-H stretching), 1229.14 cm^{-1} (-C=N- stretching), 740.22 cm^{-1} (-C-Cl stretching in aliphatic), 1053.26 cm^{-1} (C-Cl stretching in aromatic).

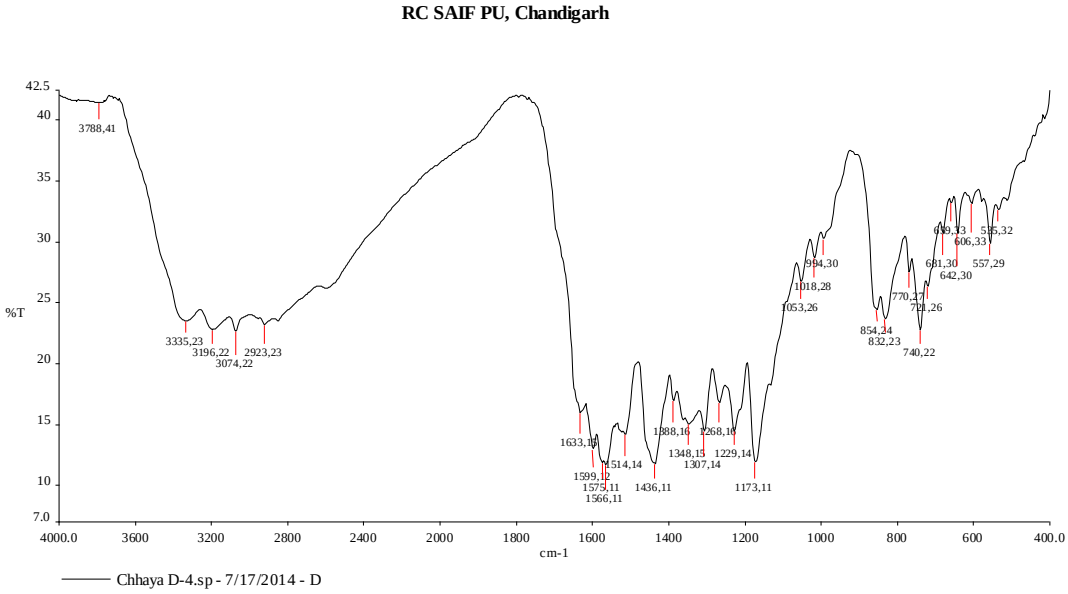
PMR: Spectrum No. 3

∂ 3.4 (hump, 2H, (-N-**H**); ∂ 6.7 (d, 1H, -CH=C-**H**-); ∂ 6.8 (d, 1H, -C**H**=C-H-); ∂ 7.1 to 8.3 (m, 6H, Ar-**H**); ∂ 12.6 (s, 1H, O-**H**)

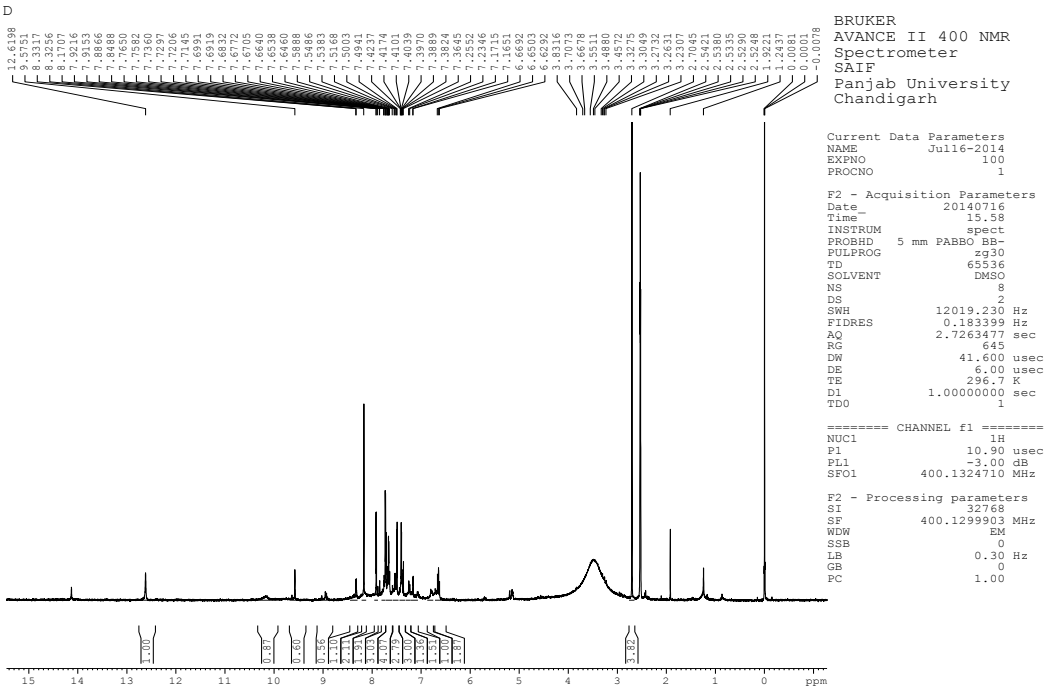
Compound (E):

UV: Spectrum No. 4

The UV-Vis spectrum of the compound (E) reported in dioxane showed λ_{max} value 490 nm corresponding to n→π* transition.



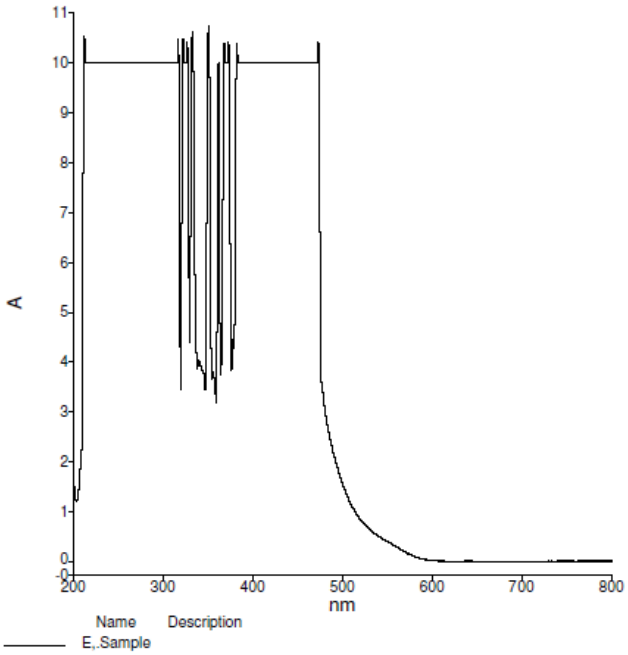
Spectrum No. 2



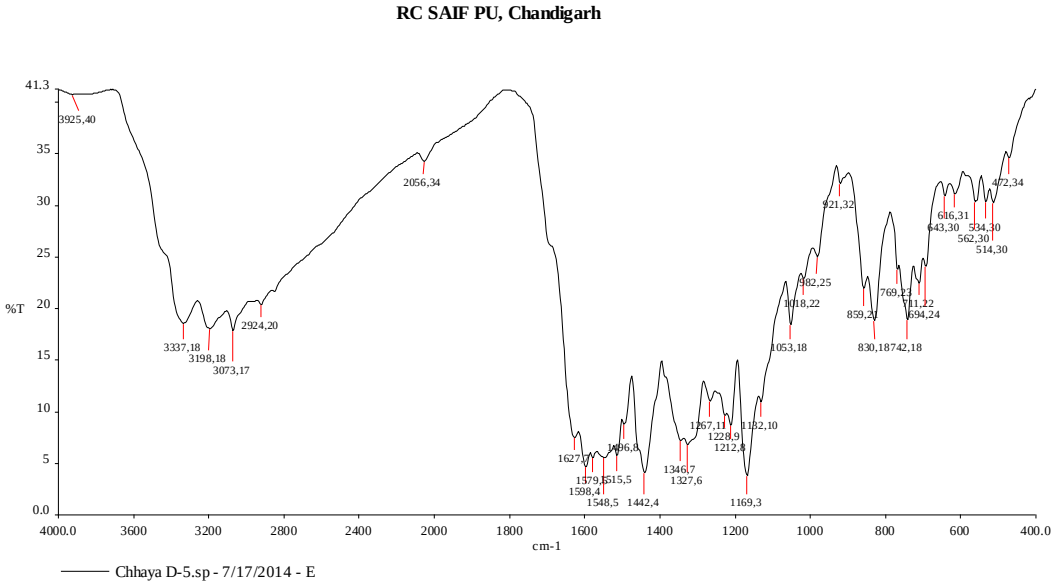
Spectrum No. 3

IR KBr: Spectrum No. 5
3337.18 cm^{-1} (O-H phenolic), 2923.20 cm^{-1} (aliphatic -C-H stretching), 3073.17 cm^{-1} (aromatic C-H stretching), 3925.40 cm^{-1} (-NH stretching), 1218.9 cm^{-1} (-C=N-stretching), 769.23 cm^{-1} [C-Cl stretching in aliphatic), 1053.18 cm^{-1} [C-Cl stretching in aromatic].
PMR: Spectrum No. 6

∂ 3.58 (hump, 1H, =N**H**); ∂ 6.64 (d 1H, -CH=C-**H**-); ∂ 6.69 (d, 1H, -C**H**=C-H-); ∂ 7.1 to 8.3 (m, 11H, Ar-**H**); ∂ 12.5 (s, 1H, O-**H**).



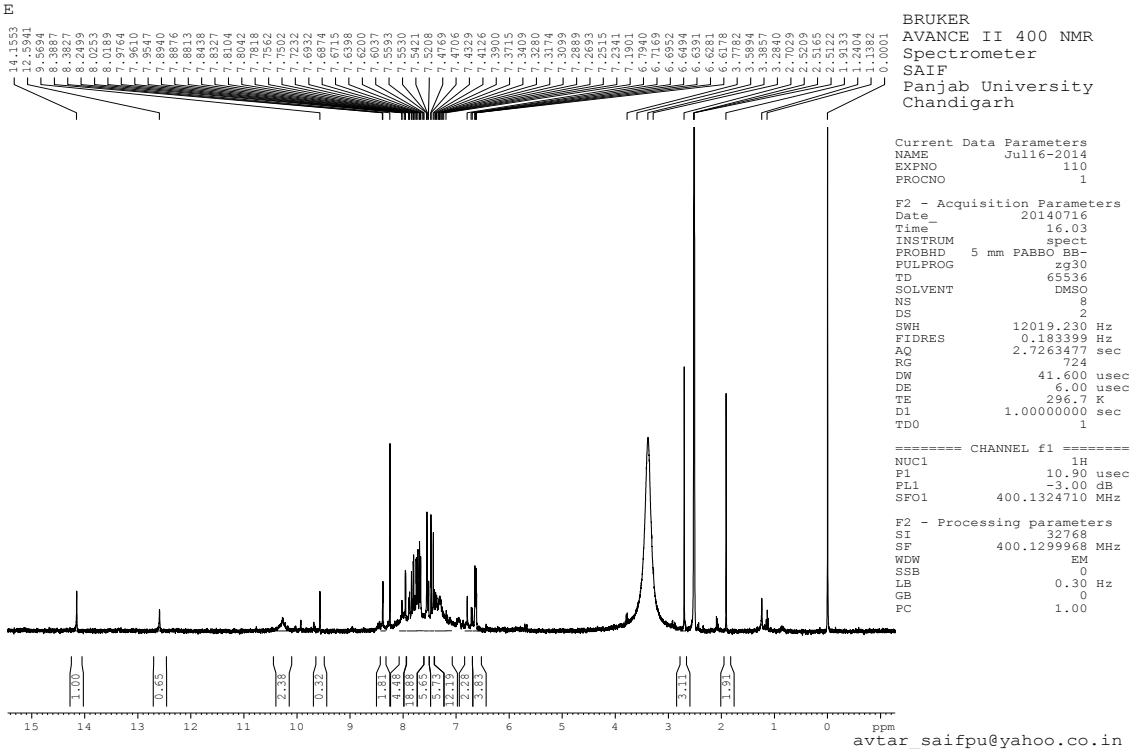
Spectrum No. 4



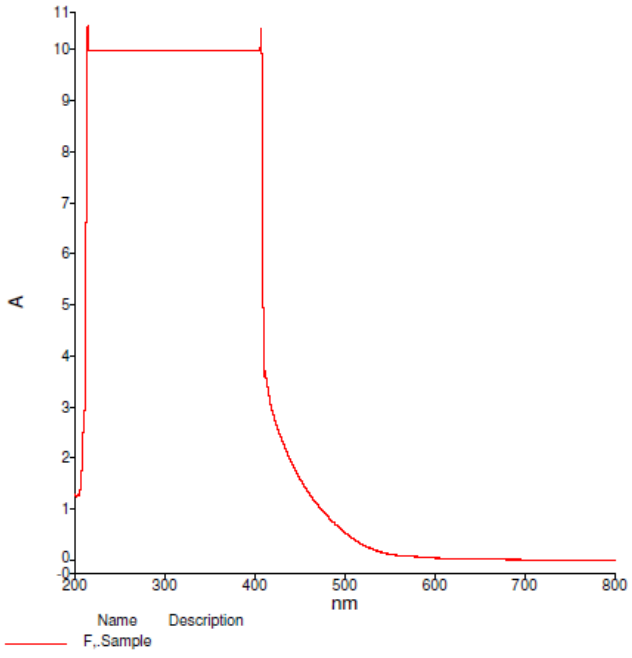
Spectrum No. 5

Compound (F):
UV: Spectrum No. 7
The UV-Vis spectrum of the compound (F) reported in dioxane showed λ_{max} value 405 nm corresponding to n→π* transition.
IR KBr: Spectrum No. 8

3025.30 cm^{-1} (-OH phenolic), 3035.51cm^{-1} (aromatic C-H stretching), 1548.5 cm^{-1} (-C=N stretching), 755.8 cm^{-1} (C-Cl stretching in aliphatic), 1072.15 cm^{-1} (C-Cl stretching in aromatic), 1344.6 (C=N stretching).



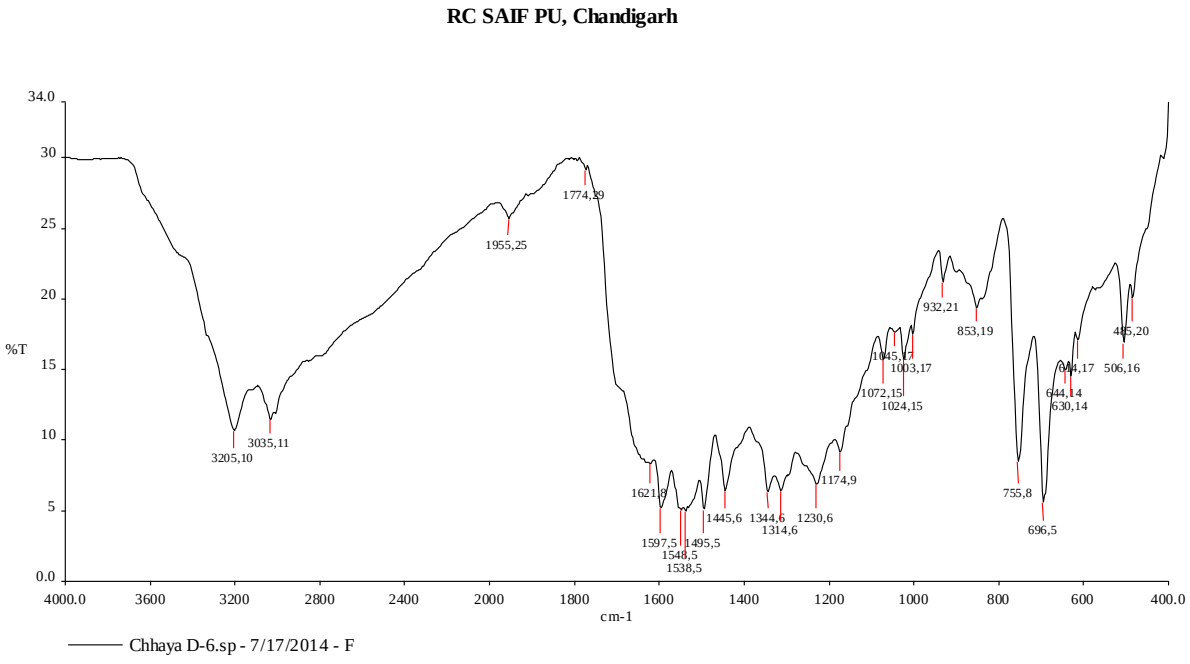
Spectrum No. 6



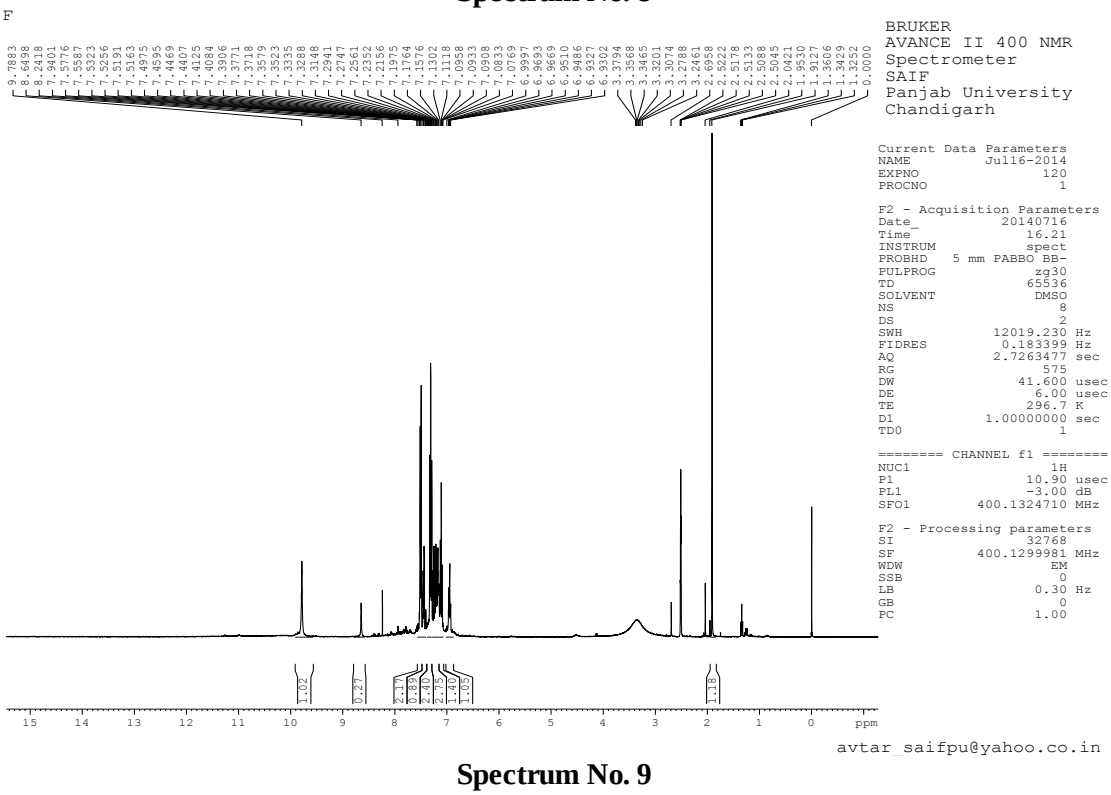
Spectrum No. 7

PMR: Spectrum No. 9

∂ 6.93 (d, 1H, d 1H, -CH=C-**H**-); ∂ 6.93 (d,1H, -C**H**=C-H-); ∂ 7.07 to 8.6 (m, 16H, Ar-**H**); ∂ 9.7 (s, 1H, O-**H**).



Spectrum No. 8



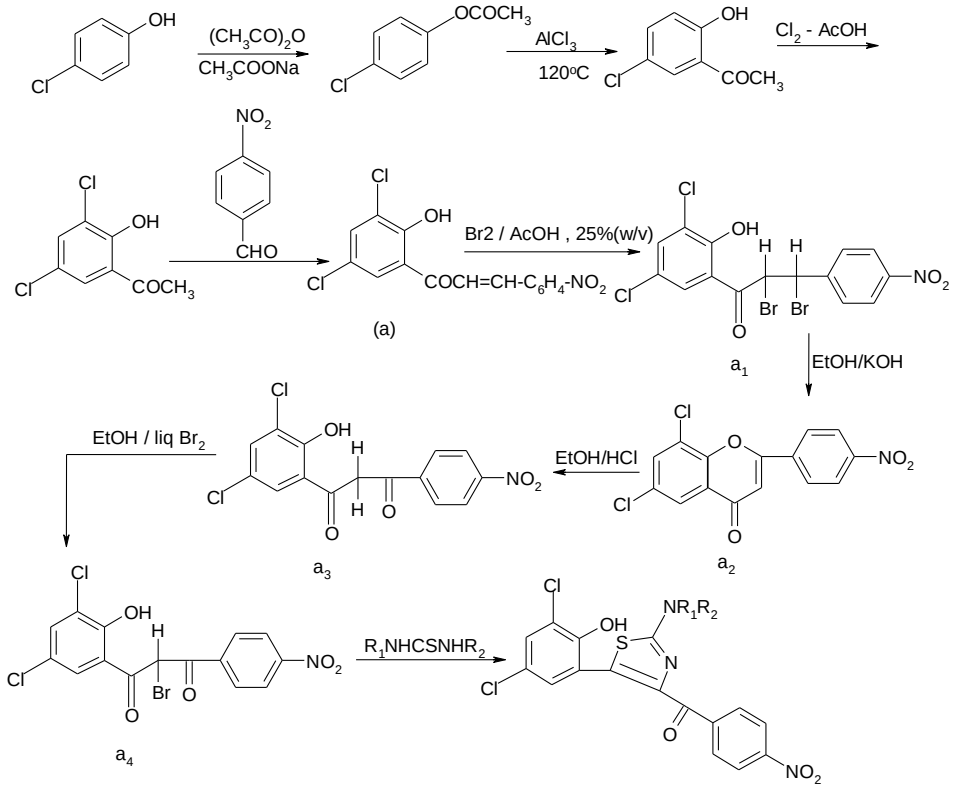
Spectrum No. 9

Preparation of Nanoparticles of the Titled Compounds

Ultrasonic Processor Sonapros PR-250MP was used to produce nanoparticles of the test compounds. The test compounds were dissolved in dioxane to prepare 0.1 M solutions. These solutions were taken in beakers and the probe of the sonapras 250 MP was dipped in solution. These solutions were exposed to sonopros MP 250 for 10 minutes separately. The test compounds were converted to nanoparticles. The solvent dioxane was evaporated by conventional heating method. The size of nanoparticles of the test compounds was confirmed by X-ray diffraction studies using Benchtop x-ray diffraction (XRD) instrument **(**Miniflex).

The thin film of the nanoparticles of the test compounds was prepared on glass slide. This slide was introduced to the X-ray diffraction instrument to get graphical information which was used for the calculation of the crystal size of test compounds.

Scheme:



Where:

1) R_1 = -H, $-C_6H_5$
2) R_2 = -H, $-C_6H_5$

Characterisation of Size of Nanoparticles of the Test Compounds:

The crystal size of nanoparticles of the test compounds calculated by using Debye-Scherrer equation.

$$D = \frac{0.94\,\lambda}{\beta.\,\cos\theta}$$

Where,

D = The average crystalline size.

0.94 = The particle shape factor which depends on the shape and size of the particle.

λ = is the wavelength.

β = is the full width at half maximum [FWHM] of the selected diffraction peaks ($\beta = 0.545$)

θ = is the Bragg's angle obtained from 2θ values which was corresponding to the maximum intensity peak in XRD pattern ($\theta = 0.7501$ rad).

Table 1: Characterisation Data of Newly Synthesized Compounds

Compounds	Molecular Formula	M.P. in ^{0}C	% of Yield	% of Element					
				C	H	N	S	Cl	Br
	$C_8H_6O_2Cl_2$	54	80	47.90/48	2.95/3			34.15/34.58	
a	$C_{15}H_9O_4NCl_2$	250	70	53.10/53.25	2.40/2.66	3.98/4.18		21/21.77	
a_1	$C_{15}H_9O_4NCl_2Br_2$	72	70	36.01/36.14	1.78/1.80	2.78/2.81		14.20/14.25	32.08/32.12
a_2	$C_{15}H_7O_4Cl_2N$	132	60	53.14/53.57	2,07/2.08	4.13/4.16		21.03/21.13	
a_3	$C_{15}H_9O_5Cl_2N$	117	50	50.74/50.84	2.45/2.54	3.90/3.95		20.03/20.05	
a_4	$C_{15}H_8O_5Cl_2BrN$	78	60	41.12/41.57	1.78/1.84	3.20/3.23		16.08/16.39	18.34/18.47
D	$C_{16}H_{11}O_4N_3Cl_2S$	170	70	46.50/46.60	2.56/2.66	10.05/10.19	7.67/7.76	17.20/17.23	
E	$C_{22}H_{15}O_4N_3Cl_2S$	168	70	54/54.09	3.0/3.07	8.56/8.60	6.50/6.55	14.50/14.54	
F	$C_{28}H_{17}O_4Cl_2N_3S$	180	75	59/59.78	3/3.02	7.4/7.47	5.6/5,69	12.6/12.63	

Activity of the Test Compounds D, E and F:

Table 2: 5-(2'-Hydroxy-3',5'-Dichlorophenyl)-4-(4"-Nitrobenzoyl)-2-Amine-1,3-Thiazole (D)

Periodicity of Observations [in Days]	*Momordica Charantia* (Bitter Guard) (Karela)				*Lageneria Siceraria* (Snake Guard) (Lavki)				*Luffa Cylindrica* (Sponge Guard) (Gilke)				*Benincasa Hispida* (Pumpkin) (Kohle)			
	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
7	2.5	1.5	2	2	2.5	1.5	2	2	4.5	5	2	2	20	23	2	3
14	7	7.2	2	2	7.5	7.2	2	2	10	8.2	2	2	20	24	2	3
21	25	20	7	6	8	13	2	4	15	13	3	6	23	24.5	3	4
28	35	40	9	10	9	20	3	6	16	38	4	9	25	25	4	5
35	47	47	10	12	11	32	4	7	20	52	5	12	32	27	5	7
42	51	51	12	15	17	59	5	9	25	83	7	17	30	32	6	9
49	55	62	14	17	25	71	6	11	30	89	8	20	35	38	8	11
56	60	80	16	19	28	90	7	13	35	103	10	26	38	52	10	15
63	67	134	18	22	31	102	8	14	40	138	12	29	42	60	12	16
70	72	142	20	28	34	109	9	16	45	145	14	32	46	65	14	18
77	75	148	22	30	36	114	10	18	50	150	16	35	49	71	16	20
84	80	152	24	32	38	120	11	20	55	154	18	38	53	76	18	22
91	82	155	26	35	40	122	12	22	57	156	20	40	56	78	20	24

Table 3: 5-(2'-Hydroxy-3',5'-Dichlorophenyl)-4-(4"-Nitrobenzoyl)-2(Phenylamino)-1,3-Thiazole (E)

Periodicity of Observations [in Days]	*Momordica Charantia* (Bitter Guard) (Karela)				*Lageneria Siceraria* (Snake Guard) (Lavki)				*Luffa Cylindrica* (Sponge Guard) (Gilke)				*Benincasa Hispida* (Pumpkin) (Kohle)			
	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
7	2.5	1.5	2	2	2.5	1.5	2	2	4.5	6	2	2	20	22.5	2	3
14	7	10	2	4	7.5	7	2	2	10	8.5	2	2	20	23	2	3
21	25	30	7	6	8	12	2	3	15	12	3	4	23	25	3	5
28	35	48	9	10	9	16	3	4	16	20	4	6	25	27	4	6
35	47	70	10	12	11	24	4	5	20	29	5	7	27	34	5	7
42	51	83	12	14	17	40	5	6	25	34	7	9	30	40	6	10
49	55	86	14	16	25	45	6	7	30	37	8	11	35	45	8	11
56	60	120	16	19	28	52	7	9	35	45	10	13	38	55	10	16
63	67	132	18	35	31	58	8	10	40	51	12	15	42	60	12	18
70	72	140	20	38	34	62	9	12	45	56	14	18	46	66	14	20
77	75	143	22	30	36	64	10	14	50	70	16	19	49	70	16	22
84	80	149	24	32	38	67	11	16	55	74	18	21	53	75	18	24
91	82	151	26	34	40	69	12	18	57	78	20	23	56	78	20	26

Table 4: 5-(2'-Hydroxy-3',5'-Dichlorophenyl)-4-(4"-Nitrobenzoyl)-2-Diphenylamino-1,3-Thiazole (F)

Periodicity of Observations [in Days]	*Momordica Charantia* (Bitter Guard) (Karela)				*Lageneria Siceraria* (Snake Guard) (Lavki)				*Luffa Cylindrica* (Sponge Guard) (Gilke)				*Benincasa Hispida* (Pumpkin) (Kohle)			
	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
7	2.5	1.5	2	2	2.5	1.5	2	2	4.5	6	2	2	20	21.5	2	3
14	7	7	2	4	7.5	7	2	2	10	8.5	2	2	20	23	2	3
21	25	15	7	6	8	12	2	4	15	12	3	4	23	24	3	5
28	35	42	9	10	9	16	3	4	16	20	4	6	25	26	4	5
35	47	45	10	12	11	24	4	5	20	29	5	7	27	32	5	7
42	51	54	12	14	17	40	5	6	25	34	7	9	30	40	6	9
49	55	60	14	16	25	45	6	7	30	37	8	11	35	45	8	12
56	60	99	16	19	28	52	7	9	35	45	10	13	38	52	10	15
63	67	104	18	25	31	58	8	10	40	57	12	15	42	61	12	17
70	72	110	20	28	34	62	9	12	45	56	14	17	46	68	14	19
77	75	114	22	30	36	64	10	14	50	59	16	18	49	75	16	20
84	80	118	24	32	38	67	11	16	55	62	18	20	53	81	18	22
91	82	121	26	34	40	69	12	18	57	65	20	23	56	84	20	24

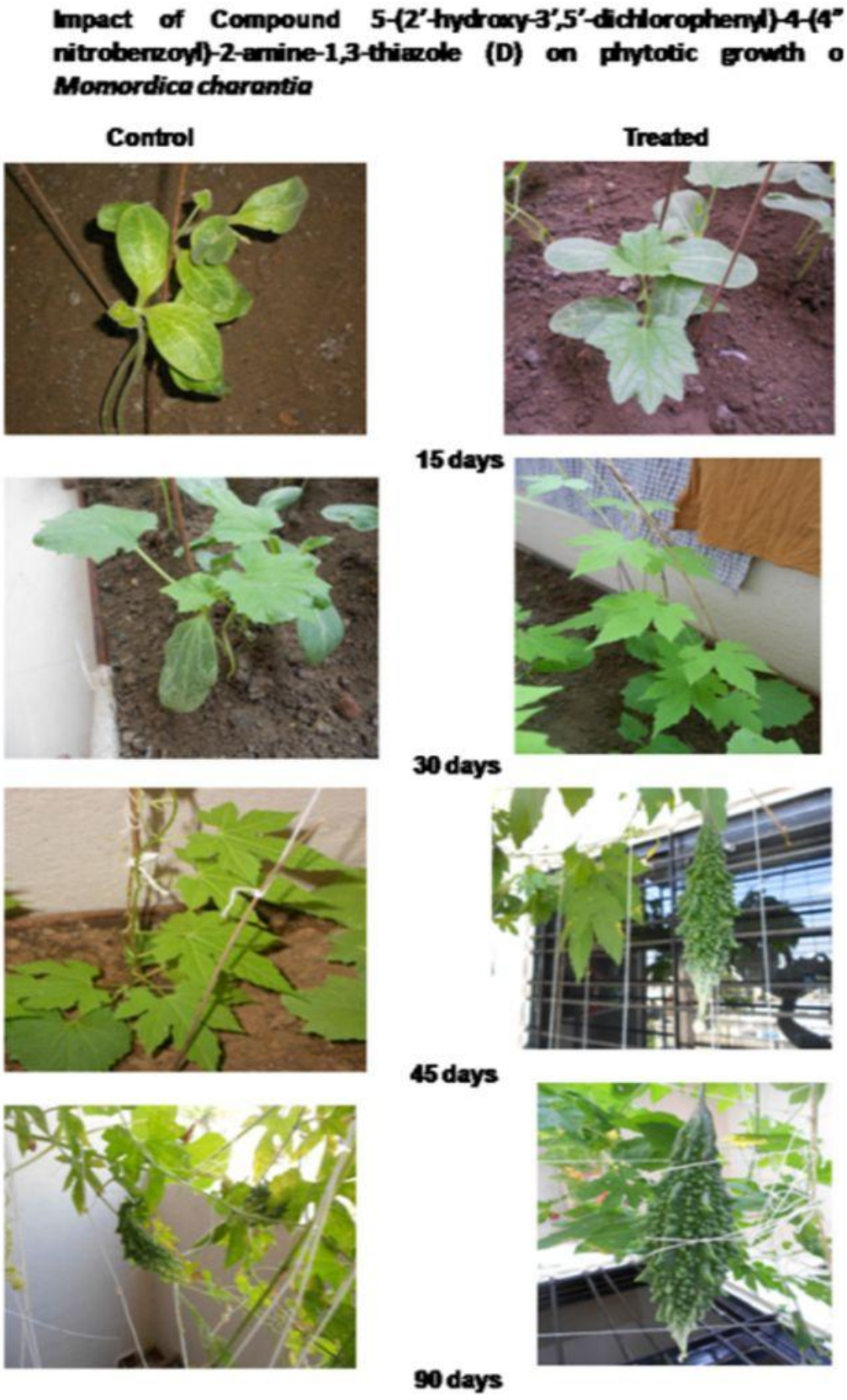

Impact of Compound 5-(2'-hydroxy-3',5'-dichlorophenyl)-4-(4" nitrobenzoyl)-2-amine-1,3-thiazole (D) on phytotic growth o Momordica charantia
Control
Treated
15 days
30 days
45 days
90 days

Figure 1

Impact of Compound 5-(2'-hydroxy-3',5'-dichlorophenyl)-4-(4"-nitrobenzoyl)-2-amine-1,3-thiazole (D) on phytotic growth of *Lageneria siceraria*

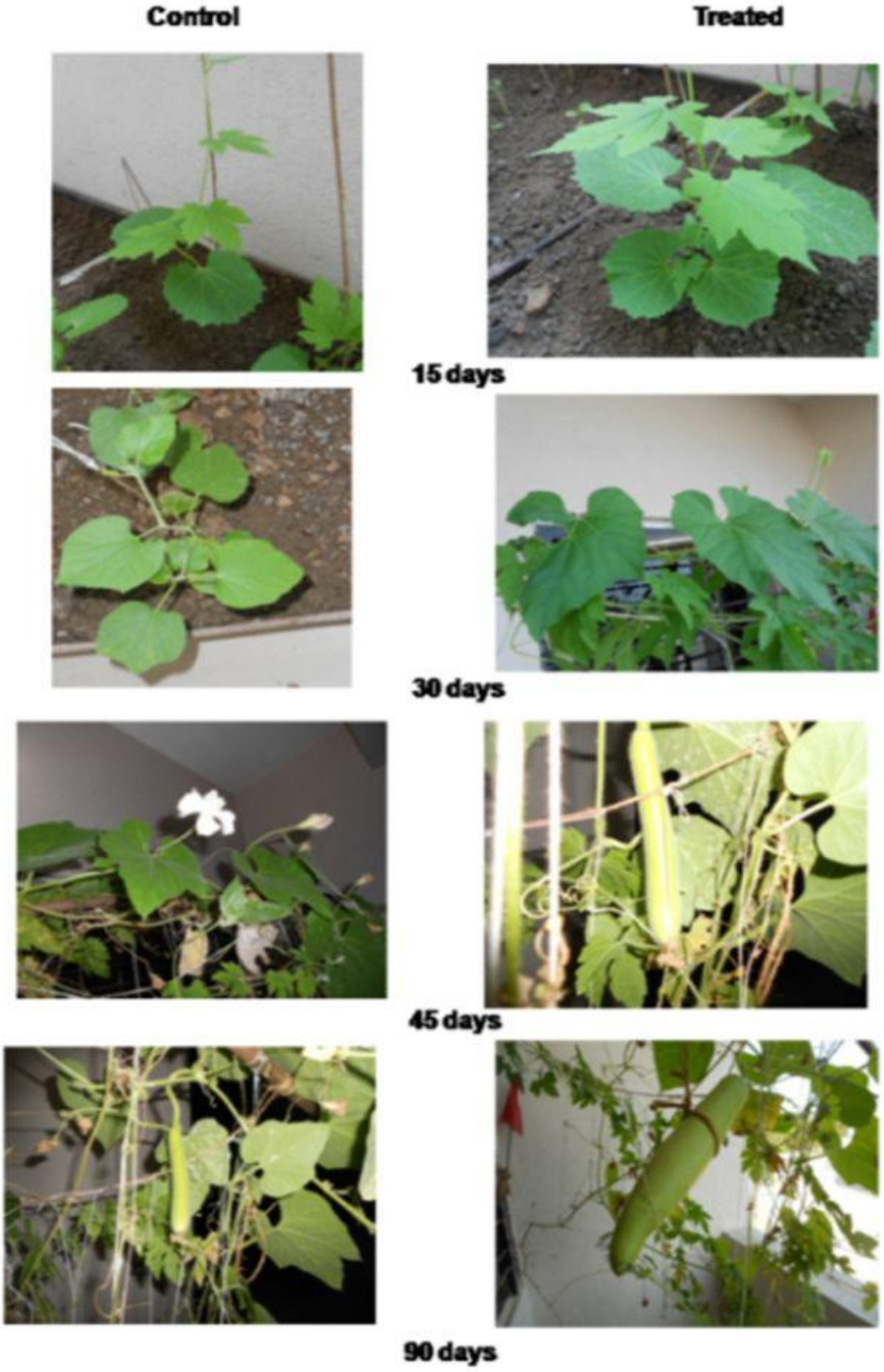


Figure 2

Impact of Compound 5-(2'-hydroxy-3',5'-dichlorophenyl)-4-(4"-nitrobenzoyl)-2-amine-1,3-thiazole (D) on phytotic growth of *Luffa cylindrica*

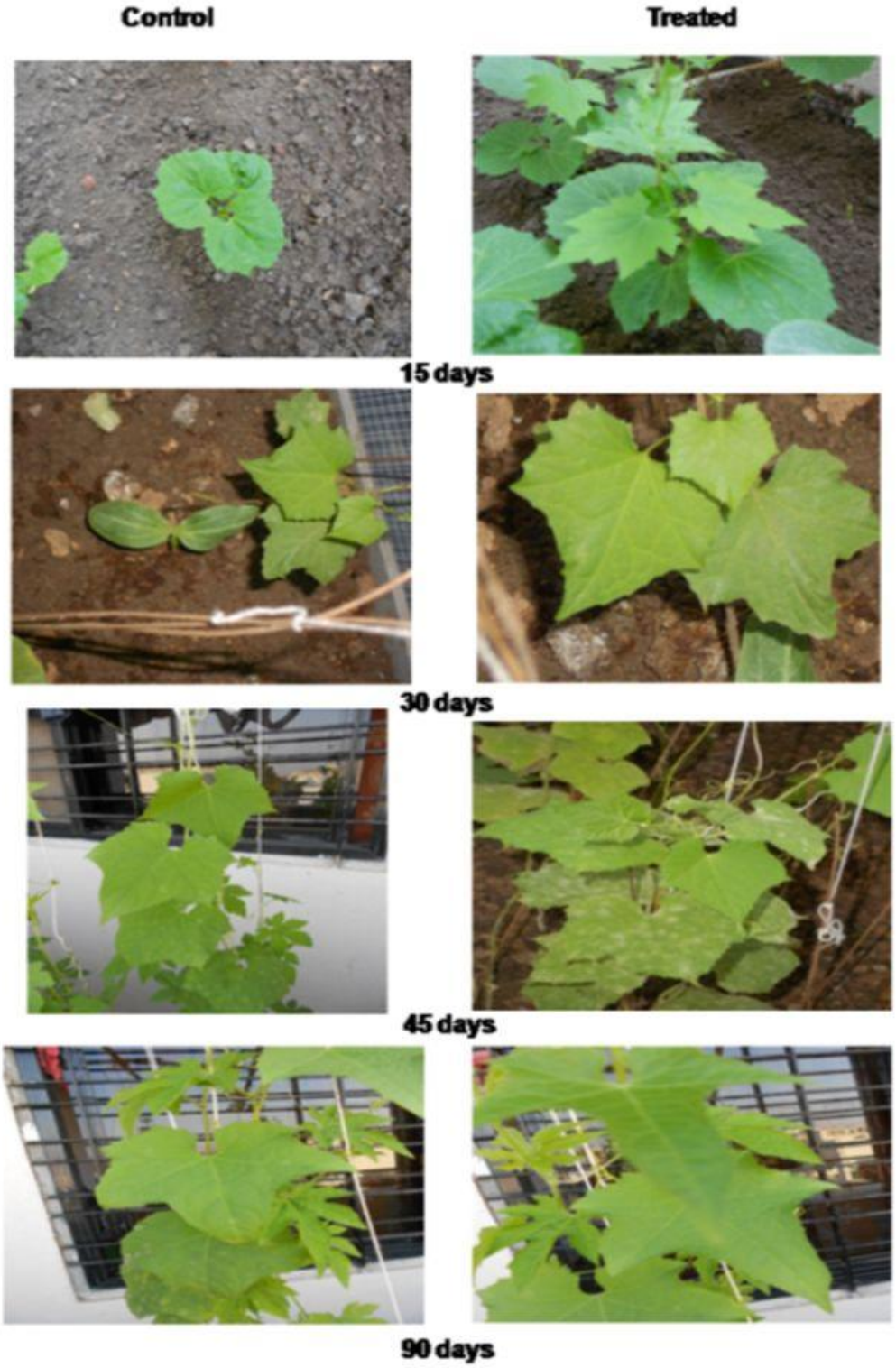


Figure 3

Impact of Compound 5-(2'-hydroxy-3',5'-dichlorophenyl)-4-(4"-nitrobenzoyl)-2-amine-1,3-thiazole (D) on phytotic growth of *Benincasa hispida*

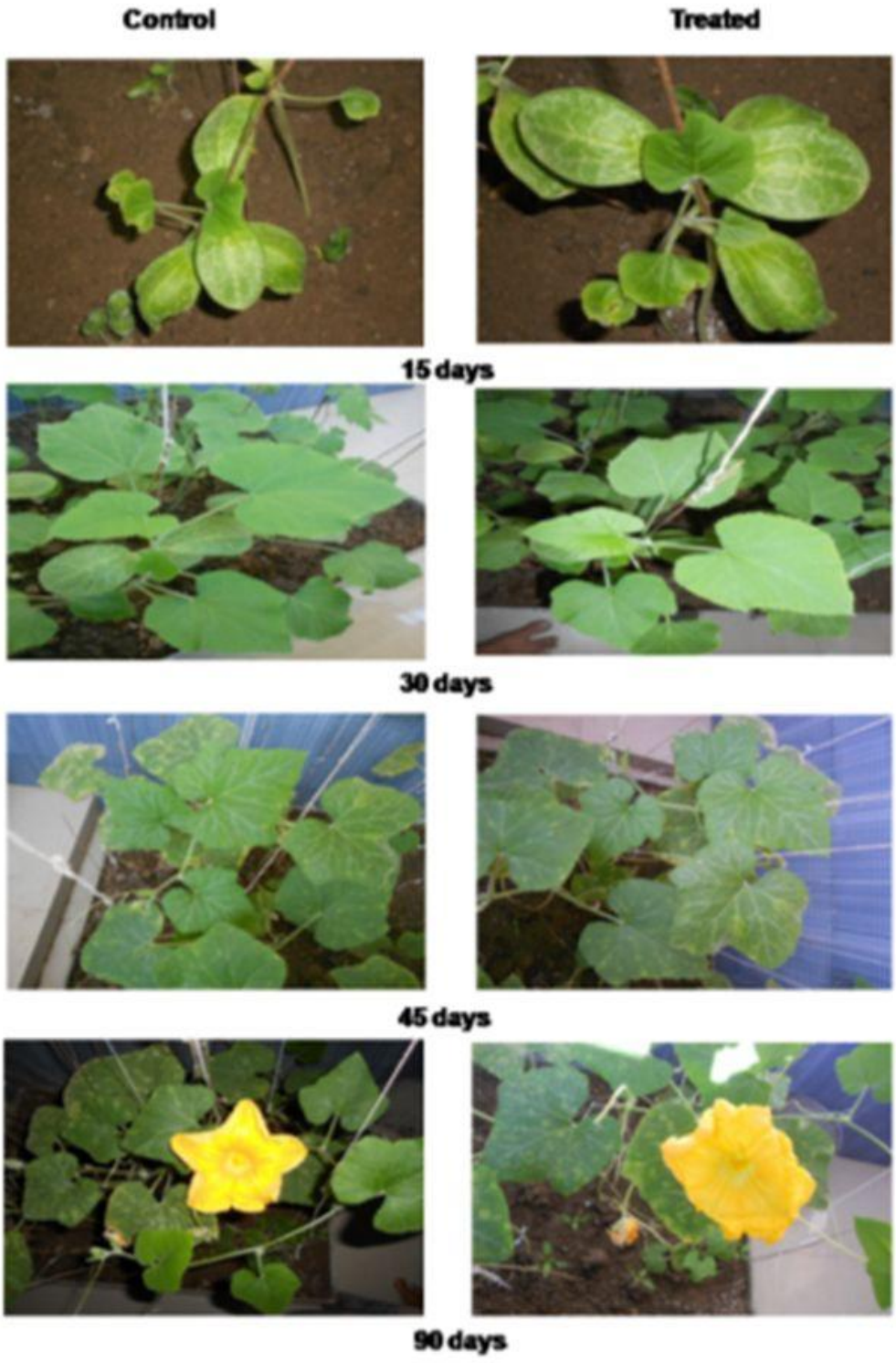


Figure 4

***Growth Promoting Effect on some Vegetable Crop Plants*:**
The experimental set up of the study was divided into two parts:
(i) Seed treatment (ii) Field experiment.
(i) Seed Treatment:
With a view to safeguard dormant seed's potential from harmful external agencies, the seeds of the test plants were treated by solution of test compounds (0.01dilution) prepared in dioxane before sowing.
(ii) Field Experiment:
Pregerminated quality seeds of *Momordica charantia L-Bitter guard (Karela), Lagneria siceraria -snake guard (Lavki), Luffa cylindrica L-Sponge guard-(Gilke) and Benincasa hispida -Pumpkin (Kohle*) were procured from Department of Horticulture, Dr. PDKV, Akola.
The beds of cotton soil, 2.5 x 2.5 m size were prepared in an open field. The sowing of seeds of all four test vegetable crop plants were done in separate beds and irrigated periodically.
The plants from each bed were divided into two groups i.e. A and B and designated as "Control" and "Treated" group plants respectively.
The plants from group B were sprayed with the solution of test compounds at weekly intervals. The field experiments were conducted to compare the treated plants of group B with untreated plants of controlled group A. In this context, the observations were recorded on 7, 14, 21, 28, 35, 42, 45, 56, 63, 70, 77, 84, 91 days after sowing corresponding to early vegetative, late vegetative, flowering, fruitification and fruit maturation, with special reference to number of leaves and height of shoots.
The results of field's experiments are tabulated in the tables 2, 3 and 4.

RESULTS AND DISCUSSION

The titled compounds and their nanoparticles were screened for their growth promoting activity on test vegetable crop plants viz, *Momordica charantia-L-Bitter guard (Karela), Lagneria siceraria-snake guard (Lavki), Luffa cylindrica L-sponge guard (Gilke) and Benincasa hispida-Pumpkin (Kohle).*
When a 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 significant shoot growth and considerable increase in the number of leaves as compared to those of untreated ones. Also it was observed that the yield of treated plants enhances to a remarkable extent than control group plants.

ACKNOWLEDGEMENTS

The authors are thankful to Dr.B.B.Wankhade, Principal, Malkapur Vidnyan Mahavidyalaya, Malkapur for providing necessary facilities to carry out the research work.

REFERENCES

Alajarin M, Cabrera J, Pastor A, Sanchez-Andrada P and Bautista D (2006). On the (2-2) Cycloaddition of 2-aminothiazoles and Dimethyl Acetylenedicarboxylate. Experimental and Computational Evidence of a Thermal Disrotatory Ring opening of Fused Cyclobutenes. *The Journal of Organic Chemistry* **71**(14) 5328-5339. Doi: 10 : 1021 / jo 06 066 4 C. (https.:/dx.doi.org/10, 1021 % 2 F jo 060 66 4 C] PMID 168 0 85 23 [https: www.ncbinlm,nih. gov / pubmed 168 08523 16 80 8523.
Jain AK, Singla RK and Shrivastava B (2011). *Pharmacology Online* **2** 1072-1084.
Kaspady M, Narayanswamyb VK, Raju M and Rao GK (2009). Synthesis, Antibacterial activity of 2, 4-Disubstituted oxazoles and Thiazoles as Bioisosters. *Letters in Drug Design and Discovery* **6** 2-28.
Kopnarr M, Cansiz A and Ahmedzade M (2004). Synthesis and Biological activity of New 2-amino-4-[3-methyl-(5,6,7,8-tetrahydro-2-napthyl) cyclobutyl] thiazole derivatives. *Russian Journal of Organic Chemistry* **40**(12) 1813-18.
Kumar A and Kumar R (2011-12). *International Research Journal of Pharmacy ISSN* 2230-8407 IRJP **2**(6).
Liu CL, Li ZM and Zhong B (2004). Synthesis and biological activity of novel 2-methyl-4-trifluoromethyl-thiazole-5-carboxamide derivatives. *Journal of Fluorine Chemistry* **125** 1287-1290.

Logu AD, Saddi M, Cardia MC, Borgna R, Sanna C, Saddi B and Maccioni E (2005). In Vitro activity of 2-cyclohexyliden-hydrazo-4- phenyl-thiazole compared with those of amphotericin B and fluconazole against clinical isolates of Candida spp. and fluconazole-resistant Candida albicans. *Journal of Antimicrobial Chemotherapy* **55** 692-98.

Patel KH and Mehta AG (2006). Synthesis and Antifungal activity of Azetidinone and thiazolidinones Derivatives of 2-Amino-6-(2-napthalenyl) thiazolo [3, 2-d] thiadiazole. *E-Journal of Chemistry* **3**(1) 3267-278.

Pattanaik J, Pattanaik M and Bhatta D (1998). *Indian Journal of Chemistry* **37B** 1304- 1306.

Patterson AM and Capell LT (1940). *The Ring Index*, (Reinhold Publishing Corp., New York, USA).

Patton SR, Dighe NS, Nirmal SA, Merekar AN, Laware RB, Shinde HV, Musmade DS (2009). Synthesis of Biological Evaluation of some sutstituted Amino Thiazole Deriovative. *Asian Journal of Research in Chemistry* **2**(2) 196.

Pullman A and Metzger J (1948). *Bulletin de la Société Chimique de France* **43** 1021, 1166, 1148.

Sanz-Cervera JF, Blasco RE, Piera J, Cynomon M, Ibanez I, Murgui'a M and Fustero S (2009). Solution versus Fluorous versus solid phase synthesis of 2, 5-Disubstituted 1,3- Azoles. Preliminary Antibacterial activity studies. *The Journal of Organic Chemistry* **74** 8988-996.

Schwarz G (1945). 2, 4-Dimethylthiazole. *Organic Syntheses* 25: 35 Collective **3** 332.

Shakeel AS, Kalyane NV, Karjgi SR and Liyakat AM (2010). Synthesis and Antibacterial activity of new schiff's bases. *International Journal of Pharmacy and Life Sciences* **1**(5) 246-49.