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Synthesis and pesticidal activities of some bis – [2-(substituted phenyl)-thiazolidin-4- one-3-yl] thioureas/ bis-[(2-methyl-2-2 substituted phenyl) thiazolidin -4- one -3- yl]thioureas

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ABSTRACT

Several bis- [2- (substituted phenyl) –thiazolidin -4- one -3-yl] thioureas/ bis – [(2-methyl -2- substituted phenyl) thiazolidin - 4- one -3-yl] thioureas have been synthesized by refluxing a mixture of dihydrazinium thiocarbazinate and substituted araldehyde in methanol with two drops of gl. AcOH for 2-3 hours forms bis – (substituted araldehyde hydrazono) – thiocarbazinate on condensation with thioglycollic acid in benzene/ by refluxing a mixture of dihydrazinimum thiocarbazinate with substituted acetophenone in methanol for 2-3 hours. The synthon thus obtained was further treated with thioglycollic acid in benzene to get the titled compounds.

Keywords: Substituted phenyl, 4-thiazolidinone, thiourea, pesticidal activity.

INTRODUCTION

Derivatives of 4- thiazolidinone have been demonstrated to possess antibacterial[1], antifungal[2], anticonvulsant[3], anti cancer[4], anti tuberculosis[5] and antihuman immune deficiency virus type 1 (HIV-1)[6] and other activities[7,8]. The literature survey revealed that many different protocols have been developed in a way that allows the synthesis of 4-thiazolidinone skeletons[9]. In continuation of our work on the synthesis and biological activity of heterocycles including 4-thiazolidinones[10-12], we report herein a simple and one pot route to the synthesis of hitherto unknown bis-[2-(substituted phenyl)-thiazolidine- 4- one- 3-yl] thioureas / bis –[(2-methy -2- substituted phenyl) thiazolidin -4- one -3-yl[thioureas derivatives in order to evaluate their pesticidal activity.

MATERIALS AND METHODS

Herbicidal Activity: All the compounds were subjected to primary post and pre-emergent herbicidal[13] evaluation at a rate of 8.0, 4.0, 1.0 and 0.5 kg ha^{-1}. The test species are *Echinochloa oryzicola, Echinochloa crusgalli, oryza sativa* and *glycine max,* using the following scores: 5, (100%); 4, (44-75%); 3, (74-35%); 2, (34-5%) and 1, (4-0%). The most active compound was found to be 3a, 3c, 3d, 3f, 5a and 5c.

Fungicidal Activity: The title compounds 3a-g and 5a-e were screened for their antifungal activity against *Pyricularia oryzae, Psedoperono spora cubensis, Sphaerotheca fuliginea* and *Phytophthora infestans* in DMSO by disc diffusion and broth dilution methods[14]. The results were compared with that of commercial fungicide.

Experimental: All melting points are uncorrected. IR spectra were recorded in KBr on a Perkin – Elmer – 881 spectrophotometer and ^{1}HNMR spectra on a Perkin-Elmer R-32 spectrometer at 60MHz.

Dihydrazinium thiocarbazinate: It was prepared by the known method[15]. A mixture of carbon disulphide and hydrazine hydrate in cold methanol was dissolved in 150ml of an aq. solution having sufficient hydrazine hydrate. (100CC water, 50CC hydrazine hydrate). The reaction mixture was refluxed on steam bath for 1 hour. The precipitated mass was collected, washed with 95% ethanol and recrystallized from water having 1 drop of methanol. m.p. 169°C, Literature [15] reports m.p. 171°C.

Sym-(substituted benzylidenimino) thioureas (2a.) Ar = 2,4- $Cl_2C_6H_3$: A mixture of dihydrazinium thiocarbazinate (1.06 g, 0.01 M) and 2,4- dichlorobenzaldehyde (3.76 g, 0.02 M) was dissolved in methanol (30 ml) with two drops of gl. AcOH. The reaction mixture was refluxed for 2 h and then poured over crushed ice. The solid mass thus obtained was filtered, washed with excess water and then recrystallized from aq. ethanol m.p. 216°C yield 88% IR (KBr): 3200 (-NH), 1600 (>C = N), 1370-CH_3 sym-bending, 1510 aromatic ring and 1170cm^{-1} (>C=S) stretching; ^{1}HNMR (DMSO-d_6) δ 3.9(s, 6H, OCH3); 4.8 (s, 2H, -N=CH); 7.2 (d, 8H, aromatic); 7.9 (d, 2H, NH).

Bis- [2- (Substituted phenyl) – thiazolidin -4- one -3- yl] thioureas. (3a) Ar= 2, 4- Cl_2 C_6H_3: This compound was prepared by condensing sym- (2, 4-dichloro benzylidenimino) – thioureas (4.2g) and thioglycollic acid (2.02CC) in benzene (50ml) for 3 hours. Excess of benzene was removed and then poured in to water; the solid mass thus obtained was washed in the sodium bicarbonate solution. It was filtered, washed with excess water dried and recrystallized with aq. ethanol m.p. 197°C yield 72%. IR (KBr): 3400 (-NH), 1710 (>C = O), 1580, 1510 aromatic ring and 1460 cm^{-1} –CH_2 bending; ^{1}HNMR (DMSO-d_6) δ 3.3 (d, 4H, CH2); 4.8 (s, 2H, CH); 7.7 (s, 6H, aromatic) 8.5-9.0 (m, 2H, NH).

Bis – (substituted acetophenone hydrazono) thiocarbazinate (4a) Ar=4-OCH_3 C_6H_4: It was prepared by taking a mixture of dihydrazinimum thiocarbazinate (1.06g) and 4-methoxy acetophenone (3.0g) in methanol (30ml) with two drops of gl. AcOH and refluxed for 2 hours It was poured into crushed ice. The compound thus obtained was filtered, washed, dried and recrystallized from aq ethanol m.p. 175°C yield 67% IR (KBr): 3240 (-NH, 1630 (>C = N), 1350 (>c=s), 1170 –C-N, 1250 -C-O-C, 1600, 1500 and 1450 cm^{-1} aromatic rings. ^{1}HNMR (DMSO-d6) δ 2.0 (m, 1H, NH), 3.73 (s, 3H, OCH_3), 4.8 (s, 1H, N=C), 7.2 (d, 8H, aromatic).

Bis – [(2-methyl-2- substituted phenyl) – thiazolidine -4- one -3yl] thioureas. (5a), Ar = 4-$OCH_3C_6H_4$: This compound was prepared by condensing bis – (4- methoxy acetophenone hydrazono) – thiocarbazinate (3.7g) with thioglycollic acid (2.02ml) in benzene (30ml) was refluxed for 3h. It was poured into crushed ice. The compound thus obtained was filtered, washed, dried and recrystallized from aq. ethanol m.p. 173°C yield 72% IR (KBr): 3400 (-NH), 1720 (>c=o), 1600 (>C=N), 1580, 1500, 1450 aromatic ring and 1170 cm^{-1} >C=S. ^{1}HNMR (DMSO-d_6): δ 3.6 (d, 4H, CH_2), 4.8 (s, 2H, CH), 3.7 (s, 3H, OCH_3), 6.8-7.3 (m, 7H, Ar-H).

Other such compounds were also prepared in a similar way and their characterization data are given in table 1.

TABLE 1. Characterization data of compounds 3a-g and 5a-e

Compounds	M.P. (°C)	Yield (%)	Mol. Formula	Found (%) (Calcd.)		
				C	H	N
3a	197	72	$C_{19}H_{14}N_4S_3O_2Cl_4$	40.00 (40.14)	2.35 (2.46)	9.72 (9.85)
3b	252	69	$C_{19}H_{18}N_4S_3O_2$	52.90 (53.02)	4.07 (4.18)	12.89 (13.00)
3c	26	68	$C_{19}H_{16}N_4S_3O_2Cl_2$	45.62 (45.09)	3.11 (3.20)	11.08 (11.22)
3d	170	64	$C_{21}H_{22}N_4S_3O_2$	55.00 (55.02)	4.80 (4.80)	12.14 (12.22)
3e	135	71	$C_{23}H_{28}N_6S_3O_2$	53.26 (53.48)	5.31 (5.42)	16.09 (16.27)
3f	166	69	$C_{21}H_{22}N_4S_3O_4$	51.34 (51.42)	4.32 (4.48)	11.35 (11.42)
3g	163	70	$C_{15}H_{14}N_4S_3O_4$	43.81 (43.90)	3.35 (3.41)	13.47 (13.65)
5a	173	72	$C_{23}H_{26}N_4S_3O_4$	53.36 (53.20)	5.78 (5.00)	10.11 (10.80)
5b	179	68	$C_{21}H_{22}N_4S_3O_2$	54.96 (55.02)	4.68 (4.80)	12.13 (12.22)
5c	240	66	$C_{21}H_{20}N_4S_3O_2Cl_2$	47.59 (47.81)	3.70 (3.79)	10.51 (10.62)
5d	292	69	$C_{21}H_{24}N_6S_3O_2$	51.44 (51.63)	4.78 (4.91)	17.09 (17.21)
5e	180	70	$C_{21}H_{22}N_4S_3O_4$	51.27 (51.42)	4.31 (4.48)	11.36 (11.42)

RESULTS AND DISCUSSION

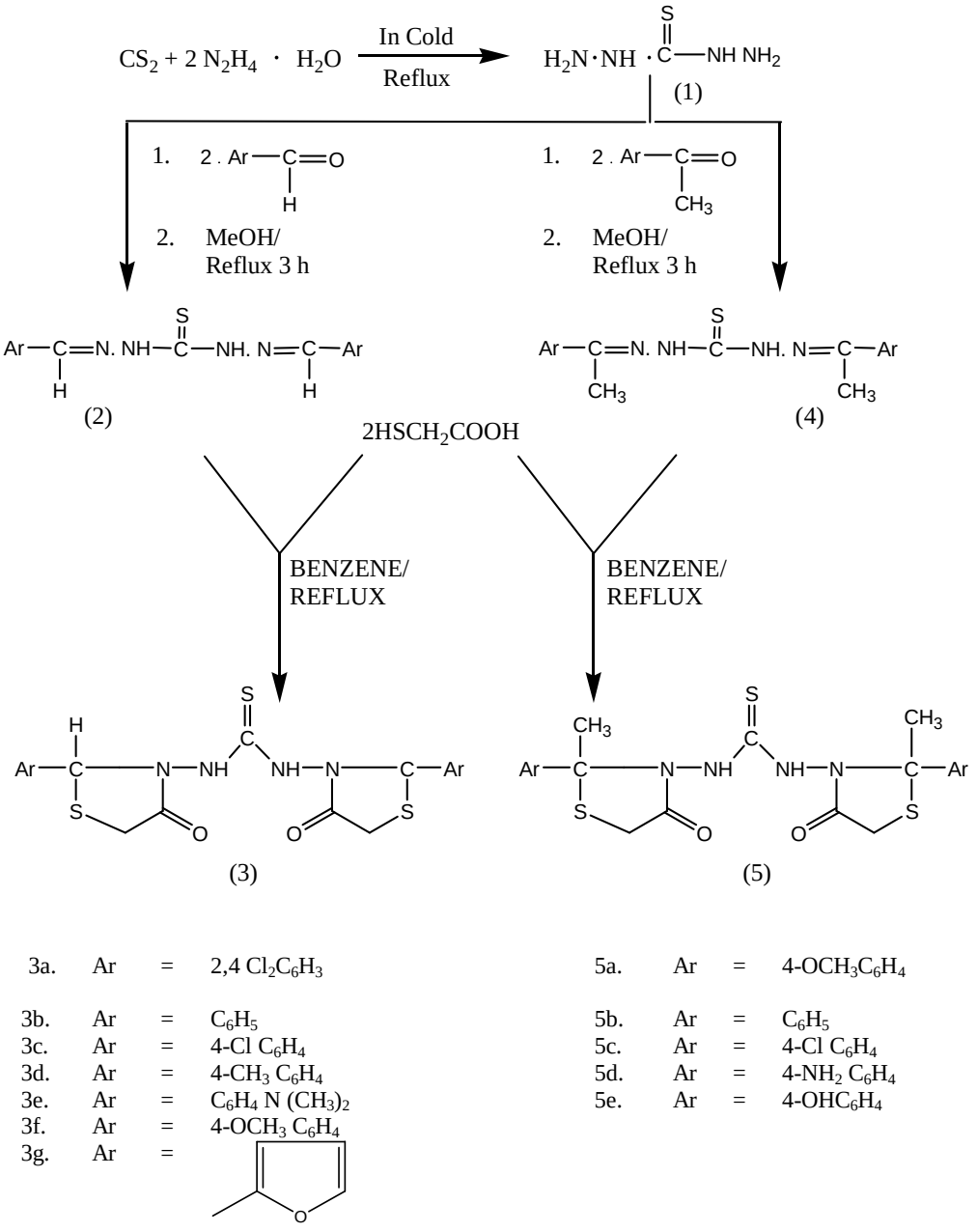
Compounds 3a-g and 5a-e were screened for their herbicidal activity against *Echinochloa oryzicola, Echinochloa crusgalli, Oryza sativa* and *Glycine max* where as fungicidal activity against *Pyricularia oryzae, Pseudoperonospora cubensis, Sphaerotheca fuliginea* and *phytophthora infestans.* The results were compared with commercial herbicides as well as fungicides under similar conditions. Amongst these the most active compounds are 3a, 3c, 3d, 3f, 5a, 5c and 5e as shown in table 2.

TABLE 2: Fungicidal activity of compounds 3a-g and 5a-e (zone of inhibition in mm)

Compound	Pyricularia oryzae	Pseudoperonospora cubensis	Sphaerotheca fuliginea	Phytopthora infestans
3a	10	10	9	10
3b	6	6	6	6
3c	10	9	10	10
3d	13	14	12	12
3e	7	7	7	7
3f	12	12	12	13
3g	8	7	7	8
5a	12	13	12	12
5b	7	7	7	7
5c	11	10	11	11
5d	9	8	8	9
5e	12	12	12	12
Carbendiazim	14	14	14	14

APPLICATIONS

We have synthesized bis-[2-(substituted phenyl) –thiazolidin -4- one -3- yl] thioureas/ bis –[(2-methyl -2-substituted phenyl) thiazolidin -4- one -3- yl] thioureas. All these compounds have been assayed for their pesticidal activities. Some of them have shown excellent pesticidal activity



3a.	Ar	=	2,4 $Cl_2C_6H_3$
3b.	Ar	=	C_6H_5
3c.	Ar	=	4-Cl C_6H_4
3d.	Ar	=	4-CH_3 C_6H_4
3e.	Ar	=	C_6H_4 N $(CH_3)_2$
3f.	Ar	=	4-OCH_3 C_6H_4
3g.	Ar	=	

5a.	Ar	=	4-$OCH_3C_6H_4$
5b.	Ar	=	C_6H_5
5c.	Ar	=	4-Cl C_6H_4
5d.	Ar	=	4-NH_2 C_6H_4
5e.	Ar	=	4-OHC_6H_4

Scheme

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