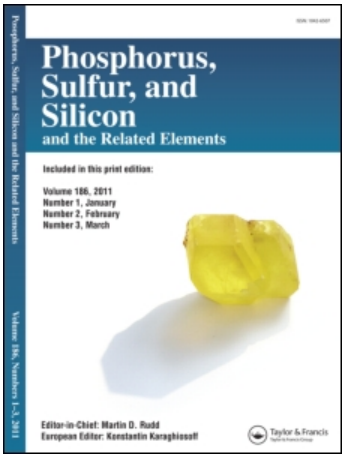

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Synthesis of Some New Thiazole, Thiophene, and 2,3-Dihydro-1,3,4-thiadiazole and Pyrimidino[1,2-b]indazole Derivatives

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Synthesis of Some New Thiazole, Thiophene, and 2,3-Dihydro-1,3,4-thiadiazole and Pyrimidino[1,2-b]indazole Derivatives

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*Hydrazonoyl halides **4a–g** reacted with methyl carbodithioate **3** thioanilide **10** to give 1,3,4-thiadiazoles **5a–g** and **13a–g**, respectively. Thioanilide **10** reacted with ω-bromoacetophenones **14a–e** to give the acyclic product **15a–e**, which was converted to the thiophenes **16a–e** and to the thiazoles **17a–e**, respectively. Structures of the newly synthesized compounds were elucidated on the basis of elemental analysis, spectral data, and alternative synthesis route whenever possible.*

Keywords Dimidone; hydrazonoyl halides; thiophene; thiazoles; thiadiazoles

INTRODUCTION

Thiazoles[1,2] and thiadiazoles have been found to exhibit diverse biological activities. They act as anticarcinogenic,[3] fungicidal,[4,5] herbicidal,[6,7] lubricant,[8] and antitumor[9] agents. In continuation of our previous work,[10–13] on the synthesis of different thiazoles, thiophenes, and 1,3,4-thiadiazoles with potential biological activities, we report the synthesis of some new thiazole, thiophene, 1,3,4-thiadiazole, and pyrimidino[1,2-b]indazole derivatives via the reaction of dimidone with different sulfur-containing compounds.

RESULTS AND DISCUSSION

The reaction of equimolar amounts of 3-{aza[(methylthiothioxom ethyl) amino]methylene}-5,5-dimethylcyclohexane-1-one (**3**) (which was prepared from the reaction of dimidone and methylhydrazinecarbodithioate in isopropyl alcohol) and C-ethoxycarbonyl-N-phenylhydrazonoyl chloride (**4a**) in ethanolic triethylamine solution

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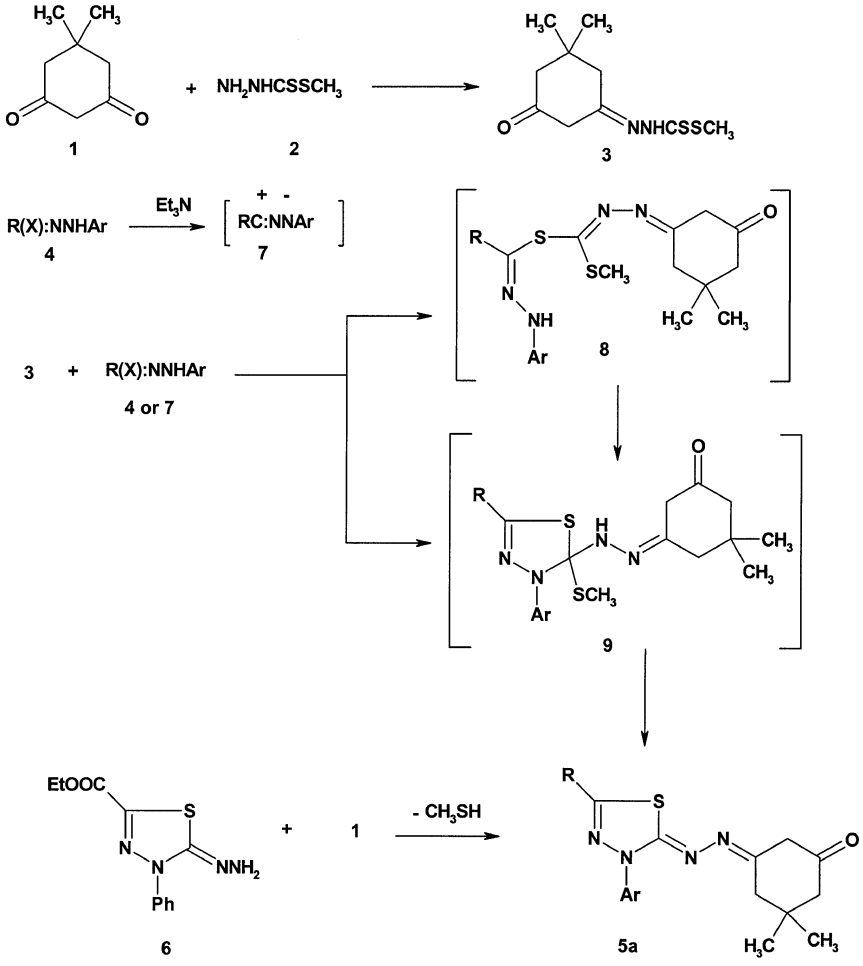
afforded product **5a**. The structure **5a** was assigned as ethyl 2-[1,2-diaza-2-(5,5-dimethyl-3-oxocyclohexylidene)ethylidene]-3-phenyl-1,3,4-thiadiazoline-5-carboxylate based on elemental analysis, spectral data, and independent synthesis. ^{1}H NMR spectrum of **5a** showed signals at $\delta = 1.03$ (s, 6H, 2 CH_3), 1.37 (t, 3H, CH_2CH_3), 2.21 (s, 2H, CH_2), 2.34 (s, 2H, CH_2), 4.39 (q, 2H, CH_2CH_3), 4.22 (s, 2H, CH_2), and 7.25–7.80 (m, 5H, ArH's). Its IR spectrum (cm^{-1}) revealed absorption bands at 1723 and 1666 (CO's). Also, compound **5a** was obtained by the reaction of 2-hydrazino-2,3-dihydro-1,3,4-thiadiazole[14] **6** with dimidone (Scheme 1).

The formation of **5a** can be explained via elimination of methyl mercaptan from the corresponding cyclo adduct **9a**, which is assumed to be formed from 1,3 dipolar cycloaddition of **4a** to C=S in **3**. Alternatively, formation of **5a** can also be explained by the 1,3 addition of **3** to the nitrilium imide **7a** (which is prepared in situ by treatment of hydrazonoyl bromide **4a** with triethylamine) to give **8a** which readily cyclized to yield **9a**, which, in turn, affords **5a** by the loss of methyl mercaptan molecule. Similarly, compound **3** reacted with the appropriate hydrazonoyl halides **4b–g** to afford 2,3-dihydro-1,3,4-thiadiazole derivatives **5b–g**, respectively.

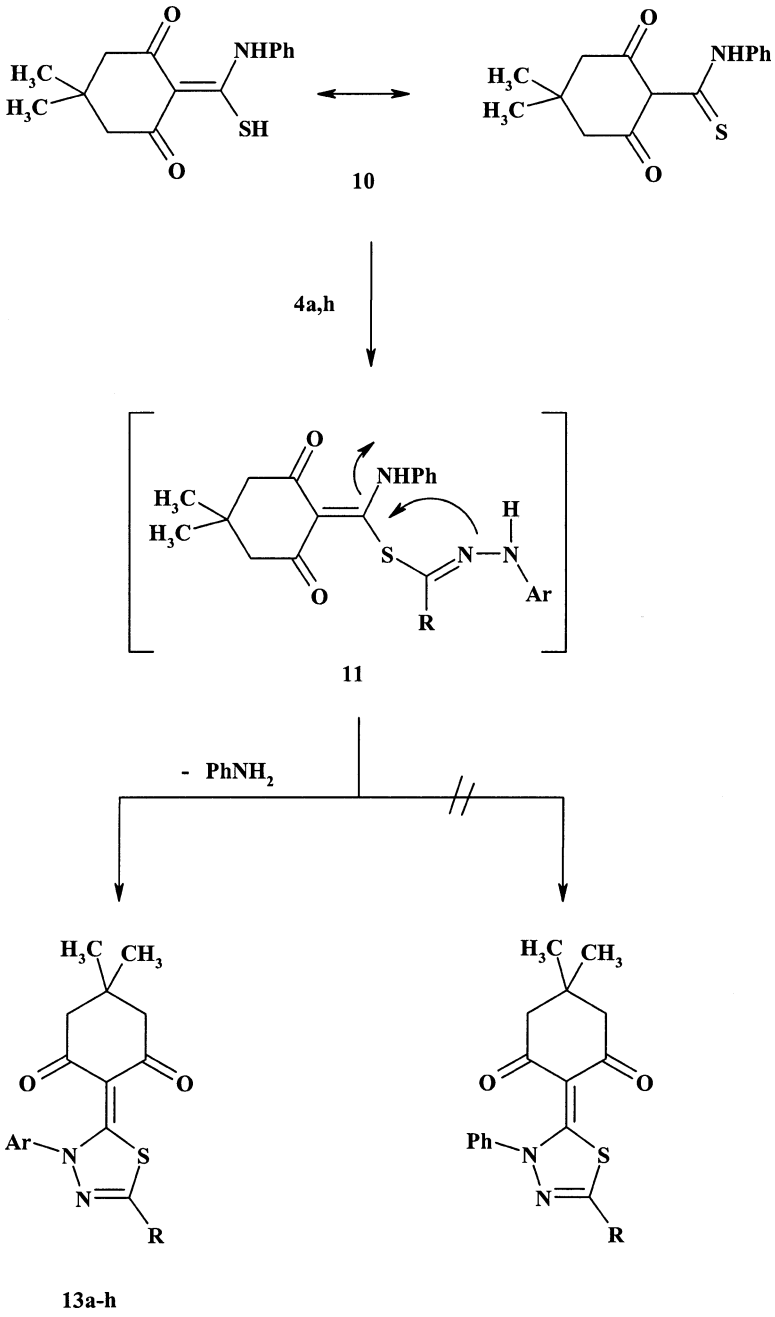
2-(Mercapto-phenylamino-methylene)-5,5-dimethyl-cyclohexane-1,3-dione[15] (**10**) with C-ethoxycarbonyl-N-phenylhydrazonoyl chloride (**4a**) in N,N-dimethylformamide contains potassium hydroxide to give one isolable product, according to TLC, which seemed to be either **12** or **13**. The structure of the product was elucidated on the basis of elemental and spectral data. Thus, IR spectrum (cm^{-1}) revealed bands at 1710, 1616, and 1620 (3 CO's). Its ^{1}H NMR spectrum showed signals at $\delta = 1.10$ (s, 6H, 2 CH_3), 1.43 (t, 3H, $\underline{CH_3}CH_2$), 2.33 (s, 2H, CH_2), 2.37 (s, 2H, CH_2), 4.48 (q, 2H, $CH_3\underline{CH_2}$), and 7.13–7.32 (m, 5H, ArH's). More evidence of the structure **13** can be obtained from the reaction of **10** with C-ethoxycarbonyl-N-p-tolylhydrazonoyl chloride (**4h**) under the same condition which gave a product having an ^{1}H NMR spectrum which showed signals at $\delta = 1.10$ (s, 6H, 2 CH_3), 1.43 (t, 3H, CH_3CH_2), 2.33 (s, 2H, CH_2), 2.37 (s, 2H, CH_2), 2.43 (s, 3H, 4-$CH_3C_6H_4$), 4.48 (q, 2H, CH_3CH_2), and 7.13–7.32 (m, 5H, ArHs). Based on the spectral data and the elemental analysis, structure **12** was ruled out and the product was assigned as ethyl 2-(4,4-dimethyl-2,6-dioxocyclohexylidene)-3-phenyl-1,3,4-thiadiazoline-5-carboxylate (**13a**). The formation of product **13a** can be explained via the reaction of **10** with hydrazonoyl chloride **4a** to form the intermediate **11**, which lost an aniline molecule[11] to give the final product **13a** (Scheme 2).

By analogy, thioamide **10** reacted with the appropriate hydrazonoyl halides **4b–g** to afford the 2,3-dihydro-1,3,4-thiadiazoles derivatives **13b–g**, respectively. For example, the ^{1}H NMR spectrum of **13e** showed



4,5a	R = $COOC_2H_5$	Ar = Ph	X = Cl
4,5b	R = CONHPh	Ar = Ph	X = Cl
4,5c	R = Ph	Ar = Ph	X = Cl
4,5d	R = $COCH_3$	Ar = Ph	X = Cl
4,5e	R = COC_6H_5	Ar = Ph	X = Br
4,5f	R = $COC_{10}H_7$	Ar = Ph	X = Br
4.5g	R = COC_4H_3S	Ar = Ph	X = Br
4h	R = $COOC_2H_5$	Ar = 4-$CH_3C_6H_4$	X = Cl

SCHEME 1



SCHEME 2

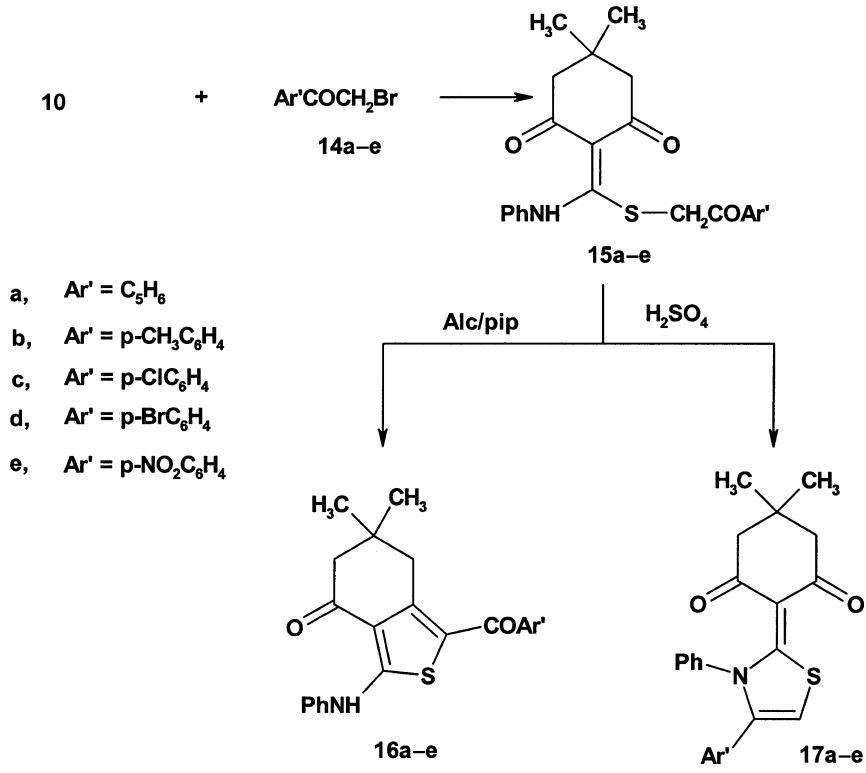
signals at $\delta = 1.06$ (s, 6H, 2 CH_3), 2.49 (s, 2H, CH_2), 2.65 (s, 2H, CH_2), and 7.15–7.50 (m, 10H, ArHs). Its ^{13}C NMR spectrum showed signals at $\delta = 28.7$, 31.1, 51.4, 105.7, 122.9, 128.9, 129.1, 130.8, 134.4, 134.8, 143.2, 183.3, and 191.9.

Treatment of **1** with phenyl isothiocyanate in N,N-dimethylformamide containing potassium hydroxide was followed by the appropriate ω-bromoacetophenones **14a–e** to afford the acyclic products **15a–e**,0 respectively. Structure **15** was established on the basis of elemental analysis, spectral data, and chemical transformation. For example, ^1H NMR spectrum of compound **15d** showed signals at $\delta = 1.09$ (s, 6H, 2 CH_3), 2.43 (s, 2H, CH_2), 2.80 (s, 2H, CH_2), 4.23 (s, 2H, SCH_2), 7.11–7.88 (m, 9H, ArH's), and 11.24 (s, 1H, NH). Its IR spectrum (cm^{-1}) revealed absorption bands at 1650, 1620, 1618 (CO's), and 3425 (NH). Thus, compound **15a–e** can be converted to the thiophenes **16a–e** by boiling in ethanol containing catalytic amount of piperidine. In contrast, the appropriate **15a–e**, when treated with conc. sulfuric acid at room temperature, was converted to the thiazoles **17a–e** respectively. The structure of these products was established on the basis of elemental analysis and spectral data (Scheme 3). For example, ^{13}C NMR spectrum of **16c** showed signals at $\delta = 28.5$, 34.3, 41.2, 52.0, 116.2, 118.3, 119.6, 125.0, 128.9, 129.9, 130.0, 138.1, 139.0, 139.3, 149.5, 162.4, 187.2, and 196.4. Its mass spectrum showed m/z peaks at 409, 410, 412, 394, 270, 214, 142, 139, and 77.

Compound **10** reacted with iodomethane in N,N-dimethylformamide containing potassium hydroxide to give 5,5-dimethyl–2-[methylthio(phenylamino)methylene]-cyclohexane-1,3-dione (**18**), which reacted with hydrazine hydrate in ethanol under reflux to give 6,6-dimethyl-3-phenylamino-2,5,6,7-tetrahydro-1H-indazol-4-one (**20**) (Scheme 4). Structure **20** was elucidated on the basis of elemental analysis and spectral data. Thus, ^1H NMR showed signals at $\delta = 1.03$ (s, 6H, 2 CH_3), 2.43 (s, 2H, CH_2), 2.60 (s, 2H, CH_2), 6.96–7.96 (m, 5H, ArHs), 9.13 (s, 1H, NH) and 12.40 (s, 1H, NH). Its mass spectrum showed m/z peaks 255, 212, 199, 170, 142, 115, 77, and 51 and the product obtained is free from sulfur. It was also prepared from the reaction of **10** with hydrazine hydrate in ethanol under reflux to give an identical product in all respects. (m.p., mixed m.p., and spectra). The reaction of **20** with ethylacetoacetate and with its trifluoro analogue in acetic acid afforded **21a** and **21b**, respectively.

EXPERIMENTAL

All melting points were determined on an electrothermal apparatus and are uncorrected. IR spectra were recorded (on KBr discs) on a Shimadzu

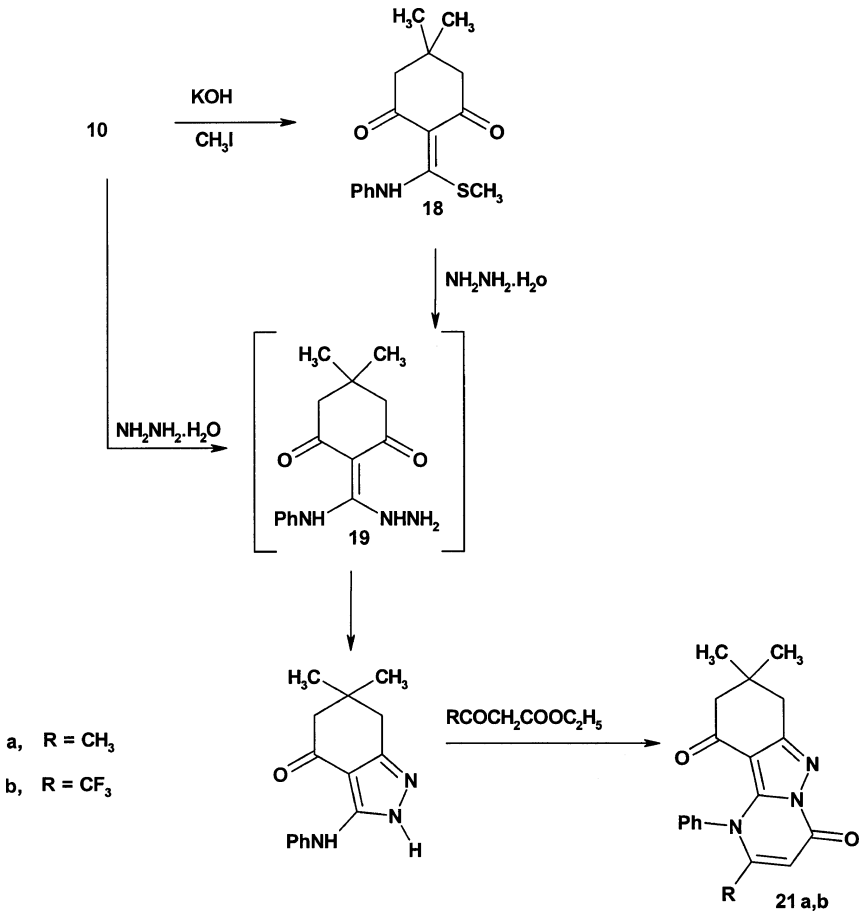


SCHEME 3

FT-IR 8201 PC spectrophotometer. 1H NMR spectra were recorded in $CDCL_3$ and $(CD_3)_2SO$ solutions on a Varian Gemini 300 MHz spectrometer and chemical shifts were expressed in δ using TMS as internal reference. ^{13}C NMR spectra were recorded in $CDCL_3$ solutions on a Varian Gemini 75 MHz spectrometer and chemical shifts were expressed in δ using TMS as internal reference. MS spectra were recorded on a GC-MS HP 5889A. Elemental analysis was carried out at the Microanalytical Center, Cairo University. Thiadiazole[14] **6**, thioanilide[15] **10**, hydrazonoyl halides[16–23] **4a–g**, and hydrazine carbodithioate[24] **2** were prepared as reported.

Synthesis of 3-{aza[(methylthiothioxomethyl) amino]methylene}-5,5-dimethylcyclohexane-1-one (3)

A mixture of dimidone **1** (0.05 mole) and methyl hydrazine carbodithioate[24] **2** (0.05 mole) was stirred in isopropyl alcohol for 1 h. The formed solid was collected by filtration and crystallized from acetic acid to give **3** (Tables I–III).



SCHEME 4

Synthesis of 2,3-Dihydro-1,3,4-thiadiazole Derivatives 5a–g

A mixture of **3** (0.005 mole), the appropriate hydrazonoyl halides[16–23] **4a–g** (0.005 mole), and triethylamine (0.005 mole) in ethanol (20 mL) was stirred for 30 min. The resulting solid was collected and crystallized from the proper solvent to give **5a–g** (Tables I–III).

Synthesis of 2,3-Dihydro-1,3,4-thiadiazole Derivatives 13a–h

A mixture of **1** (0.01 mole), phenyl isothiocyanate (0.01 mole), and potassium hydroxide (0.01 mole) in N.N-dimethylformamide (20 mL) was stirred for 3 h at room temperature. The appropriate hydrazonoyl

TABLE I Characterization Data of the Newly Synthesized Compounds

Compound no.	Mp.,°C solvent	Colour yield %	Mol. formula (Mol. Wt.)	% Analyses, calcd./found C	H	N	S
3	210–13	Yellow	$C_{10}H_{16}N_2OS_2$	49.15	6.60	11.46	26.24
	ACOH	89	(244.38)	49.00	6.50	11.30	26.10
5a	115–17	Yellow	$C_{19}H_{22}N_4O_3S$	59.05	5.74	14.50	8.30
	EtOH	65	(386.48)	59.20	5.90	14.70	8.50
5b	180–83	Yellow	$C_{23}H_{23}N_5O_2S$	63.72	5.35	16.15	7.40
	EtOH	67	(433.54)	63.50	5.10	15.90	7.20
5c	155–56	Yellow	$C_{22}H_{22}N_4OS$	67.67	5.68	14.35	8.21
	EtOH	59	(390.51)	67.80	5.80	14.50	8.00
5d	140–43	Orange	$C_{18}H_{20}N_4O_2S$	60.65	5.66	15.72	9.00
	EtOH	55	(356.45)	60.40	5.40	15.50	8.90
5e	80–83	Red	$C_{23}H_{22}N_4O_2S$	66.01	5.30	13.39	7.66
	EtOH	59	(418.52)	66.30	5.50	13.50	7.80
5f	185–86	Red	$C_{27}H_{24}N_4O_2S$	69.21	5.16	11.96	6.84
	EtOH	55	(468.58)	69.00	4.90	11.70	6.60
5g	120–22	Brown	$C_{21}H_{20}N_4O_2S_2$	59.41	4.75	13.20	15.11
	EtOH	75	(424.55)	59.60	4.80	13.40	15.30
13a	138–40	Yellow	$C_{19}H_{20}N_2O_4S$	61.27	5.41	7.52	8.61
	EtOH	75	(372.45)	61.40	5.30	7.30	8.60
13b	245–47	Yellow	$C_{23}H_{21}N_3O_3S$	65.85	5.05	10.02	7.64
	DMF	79	(419.51)	65.60	4.90	9.90	7.40
13c	138–40	Yellow	$C_{22}H_{20}N_2O_2S$	70.19	5.35	7.44	8.52
	EtOH	73	(376.48)	70.30	5.10	7.20	8.30
13d	199–200	Orange	$C_{18}H_{18}N_2O_3S$	63.14	5.30	8.18	9.36
	EtOH	80	(342.42)	63.30	5.00	8.00	9.20
13e	209–11	Orange	$C_{23}H_{20}N_2O_3S$	68.30	4.98	6.93	7.93
	ACOH	75	(404.49)	68.10	5.00	6.70	7.80
13f	147–50	Orange	$C_{27}H_{22}N_2O_3S$	71.35	4.88	6.16	7.05
	ACOH	79	(454.55)	71.50	5.00	6.00	6.90
13g	217–20	Yellow	$C_{21}H_{18}N_2O_3S_2$	61.44	4.42	6.82	15.62
	ACOH	78	(410.52)	61.20	4.20	6.60	15.40
15a	138–40	White	$C_{23}H_{23}NO_3S$	70.20	5.89	3.56	8.15
	EtOH	85	(393.51)	70.40	6.00	3.70	8.30
15b	145–46	White	$C_{24}H_{25}NO_3S$	70.73	6.18	3.44	7.87
	EtOH	87	(407.54)	70.90	6.30	3.60	7.90
15c	160–62	White	$C_{23}H_{22}ClNO_3S$	64.55	5.18	3.27	7.49
	ACOH	83	(427.95)	64.20	4.90	3.10	7.50
15d	159–60	Yellow	$C_{23}H_{22}BrNO_3S$	58.48	4.49	2.96	6.79
	ACOH	85	(472.40)	58.40	4.50	2.90	6.70
15e	190–92	Orange	$C_{23}H_{22}N_2O_5S$	63.00	5.06	6.39	7.31
	ACOH	78	(438.51)	63.20	5.20	6.50	7.50
16a	150–51	Yellow	$C_{23}H_{21}NO_2S$	73.57	5.64	3.73	8.54
	EtOH	80	(375.49)	73.30	5.40	3.50	8.30
16b	180–82	Yellow	$C_{24}H_{23}NO_2S$	74.01	5.95	3.60	8.23
	EtOH	75	(389.52)	73.90	6.00	3.50	8.20

TABLE I Characterization Data of the Newly Synthesized Compounds *(Continued)*

Compound no.	Mp.,°C solvent	Colour yield %	Mol. formula (Mol. Wt.)	% Analyses, calcd./found C	H	N	S
16c	159–60	Yellow	$C_{23}H_{20}ClNO_2S$	67.39	4.92	3.42	7.81
	EtOH	79	(409.94)	67.20	4.70	3.20	7.60
16d[15]	165–67	Yellow	$C_{23}H_{20}BrNO_2S$	60.80	4.44	3.08	7.06
	EtOH	75	(454.39)	60.60	4.20	2.90	7.00
16e	188–90	Yellow	$C_{23}H_{20}N_2O_4S$	65.70	4.79	6.66	7.63
	EtOH	84	(420.49)	65.50	4.60	6.40	7.40
17a	250–53	White	$C_{23}H_{21}NO_2S$	73.57	5.64	3.73	8.54
	EtOH	75	(375.49)	73.40	5.50	3.60	8.30
17b	>340	White	$C_{24}H_{23}NO_2S$	74.01	5.95	3.66	8.23
	EtOH	73	(389.52)	73.90	6.00	3.50	8.20
17c	296–300	Yellow	$C_{23}H_{20}ClNO_2S$	67.39	4.92	3.42	7.82
	EtOH	69	(409.94)	67.30	4.90	3.30	7.60
17d	282–85	Yellow	$C_{23}H_{20}BrNO_2S$	60.80	4.44	3.08	7.06
	EtOH	75	(454.39)	60.70	4.30	3.10	7.00
17e	269–70	Yellow	$C_{23}H_{20}N_2O_4S$	65.70	4.79	6.66	7.63
	EtOH	79	(420.49)	65.60	4.70	6.50	7.50
18	135–37	White	$C_{16}H_{19}NO_2S$	66.41	6.62	4.84	11.08
	EtOH	55	(289.40)	66.20	6.40	4.60	10.90
20	235–36	Yellow	$C_{15}H_{17}N_3O$	70.56	6.71	16.46	
	EtOH	79	(255.32)	70.40	6.50	16.20	
21a	278–80	Yellow	$C_{19}H_{19}N_3O_2$	71.01	5.96	13.07	
	ACOH	65	(321.38)	71.00	6.00	13.00	
21b	268–70	Yellow	$C_{19}H_{16}F_3N_3O_2$	60.80	4.30	11.19	
	ACOH	63	(375.35)	60.60	4.10	11.00	

halides **4a–h** (0.01 mole) were added and stirring was continued for 2 h. The reaction mixture was diluted with water and the solid that was precipitated was collected and crystallized from the proper solvent to give **13a–g** (Tables I–III).

Synthesis of 5,5-Dimethyl-2-[(2-oxo-2-arylethylthio)(phenylamino)-methylene] cyclohexane-1,3-dione 15a–e

A mixture of **1** (0.01 mole), phenyl isothiocyanate (0.01 mole), and potassium hydroxide (0.01 mole) in N,N-dimethylformamide (20 mL) was stirred for 3 h at room temperature. The appropriate *ώ*-bromoacetophenones **14a–e** (0.01 mole) was added and stirring was continued for 2 h. The formed solid was collected and crystallized from the proper solvent to give **15a–e** (Tables I–III).

TABLE II ^{1}H NMR Spectrum of Some Newly Synthesized Compounds

Compound no.	^{1}H NMR (δ ppm)
3	1.03 (s, 6H, 2 CH_3), 2.07 (s, 2H, CH_2), 2.21 (s, 2H, CH_2), 2.31 (s, 3H, SCH_3), 4.28 (s, 2H, CH_2), and 11.56 (s, 1H, NH).
5e	1.06 (s, 6H, 2 CH_3), 2.44 (s, 2H, CH_2), 2.68 (s, 2H, CH_2), 4.22 (s, 2H, CH_2) and 7.39–8.23 (m, 10H, ArHs).
13b	1.03 (s, 6H, 2 CH_3), 2.30 (s, 2H, CH_2), 2.50 (s, 2H, CH_2), 7.20–7.80 (m, 10H, ArHs) and 10.81 (s, 1H, NH).
13d	1.01 (s, 6H, 2 CH_3), 2.33 (s, 3H, CH_3CO), 2.50 (s, 2H, CH_2), 2.66 (s, 2H, CH_2) and 7.15–7.50 (m, 5H, ArHs).
15a	1.21 (s, 6H, 2 CH_3), 2.35 (s, 2H, CH_2), 2.96 (s, 2H, CH_2), 4.23 (s, 2H, SCH_2), 7.07–8.05 (m, 10H, ArHs), and 11.28 (s, 1H, NH).
15b	1.25 (s, 6H, 2 CH_3), 2.33 (s, 2H, CH_2), 2.52 (s, 2H, CH_2), 2.32 (s, 3H, 4-$CH_3C_6H_4$), 4.26 (s, 2H, SCH_2), 7.07–7.91 (m, 9H, ArHs) and 11.26 (s, 1H, NH).
15c	1.04 (s, 6H, 2 CH_3), 2.08 (s, 2H, CH_2), 2.20 (s, 2H, CH_2), 4.75 (s, 2H, SCH_2), 7.06–8.03 (m, 9H, ArHs), and 11.23 (s, 1H, NH).
15d	1.09 (s, 6H, 2 CH_3), 2.43 (s, 2H, CH_2), 2.80 (s, 2H, CH_2), 4.30 (s, 2H, SCH_2), 7.11–7.88 (m, 9H, ArHs), and 11.24 (s, 1H, NH).
16b	1.00 (s, 6H, 2 CH_3), 2.32 (s, 2H, CH_2), 2.31 (s, 3H, 4-$CH_3C_6H_4$), 2.70 (s, 2H,CH_2), 7.01–7.69 (m, 9H, ArHs), and 11.32 (s, 1H, NH).
21a	1.06 (s, 6H, 2 CH_3), 2.29 (s, 2H, CH_2), 2.68 (s, 2H, CH_2), 2.92 (s, 3H, CH_3), and 7.07–8.05 (m, 6H, ArH's and CH).
21b	1.06 (s, 6H, 2 CH_3), 2.29 (s, 2H, CH_2), 2.68 (s, 2H, CH_2), and 7.07–8.05 (m, 6H, ArH's and CH).

Synthesis of 6,6-Dimethyl-3-(phenylamino)-1-(arylcarbonyl)-5,6,7-trihydrobenzo[2,1-c]thiophen-4-one 16a–e

Compounds **15a–e** (0.005 mole) were refluxed in ethanol (20 mL) that contained a catalytic amount of piperidine for 1 h. The resulting solid was collected and cyrstallized from the proper solvent to give **16a–e** (Tables I–III).

Synthesis of 2-(4-(Substituted)-3-Phenyl-(1,3-thiazolin-2-ylidene))-5,5-dimethyl-cyclohexane-1,3-dione 17a–e

A mixture of **15a–e** (0.005 mole) with conc. sulfuric acid (10 mL) was stirred for 1 h at room temperature and then poured on to ice. The formed solid was collected and crystallized from the proper solvent to give **17a–e** (Tables I–III).

Synthesis of 5,5-Dimethyl-2-[methylthio(phenylamino) methylene]-cyclohexane-1,3-dione (18)

A mixture of **1** (0.01 mole), phenyl isothiocyanate (0.01 mole), and potassium hydroxide (0.01 mole) in N,N-dimethylformamide (20 mL) was

TABLE III Mass Spectra of Some Newly Synthesized Compounds

Compound no.	M+ m/z
3	244, 196, 171, 146, 110, 83, 55.
5b	433, 404, 377, 323, 296, 244, 188, 110, 91, 77.
5d	356, 357, 341, 328, 313, 300, 255, 205, 187, 135, 110, 77.
5e	418, 403, 375, 313, 255, 198, 161, 105, 77.
5f	468, 385, 331, 312, 242, 155, 127, 77.
5g	424, 381, 288, 276, 196, 171, 111, 83.
13f	454, 407, 225, 155, 127, 77.
13g	410, 326, 313, 245, 217, 143, 111, 77.
15b	407, 374, 313, 274, 226, 165, 119, 91.
16a	375, 376, 360, 214, 149, 105, 77.
16e	420, 405, 150, 104, 77.
17b	389, 375, 362, 329, 273, 238, 214, 152, 105, 84.
17c	409, 410, 411, 412, 353, 312, 285, 247, 214, 168, 136, 77, 55.
17d	453, 455, 358, 356, 275, 247, 180, 103, 77, 55.
17e	420, 364, 323, 321, 147, 89, 55.

stirred for 3 h at room temperature. Iodomethane (0.01 mole) was added and stirring was continued for 2 h. The formed solid was collected and crystallized from ethanol to give **18** (Tables I and II).

Synthesis of 6,6-Dimethyl-3-(phenylamino)-2,5,6,7-tetrahydro-1H-indazol-4-one (20)

A mixture of **18 (or 10)** and hydrazine hydrate (0.01 mole) was refluxed in ethanol (20 mL) for 2 h. The formed solid was collected and crystallized from ethanol to give **20** (Tables I and II).

Synthesis of 2-Substituted-7,7-dimethyl-1,6,7,8,4a-pentahydropyrimidino[1,2-b] 1H-indazole-4, 9-dione 21a,b

A mixture of **20** and ethylacetoacetate and trifluoromethyl ethylacetoacetate was refluxed in acetic acid for 3 h. The formed solid was collected and crystallized from acetic acid to give **21a** and **21b**, respectively

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