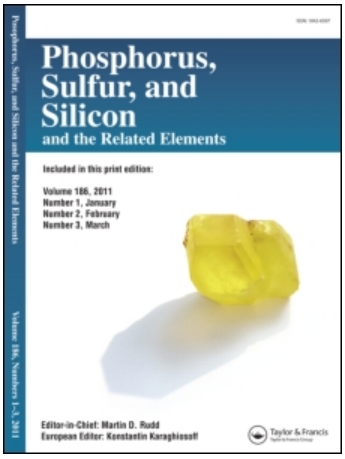

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SYNTHESIS OF PYRIDAZOTHIENOTHIAZINE AND PYRIMIDOTHIENOPYRIDAZINES

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SYNTHESIS OF PYRIDAZOTHIENOTHIAZINE AND PYRIMIDOTHIENOPYRIDAZINES

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3-amino-4,5-diphenylthieno[2,3-c]pyridazine-2-arylcarboxamide **2** underwent cyclization with triethyl orthoformate and with nitrous acid to give the pyrimidothienopyridazines **3a-c, 4b** respectively. 3-amino-4,5-diphenylthieno[2,3-c] pyridazine-2-carbohydrazide **6** reacted with aromatic aldehydes to give the corresponding carbohydrazones **7a-c**. Compound **7** reacts with triethyl orthoformate, acetic anhydride or with CS_2/pyridine to produce pyrimidothienopyridazines **8,9** and pyridazothienothiazine **11**.

Keywords: Thienopyridazines; Pyrimidothienopyridazanies; Pyridazothienothiazines

INTRODUCTION

Recently a number of reports concerning the synthesis of some pyridazine derivatives have been shown to possess a variety of biological activities including, as anticonvulsants[1], acetylcholinesterase inhibitors[2], antiinflammatory and analgesic activity[3]. Also, thienothiazines have been found to be biologicaly important compounds, which used as antiinflammatory[4] and as carbonic anhydrase inhibitors[5]. In addition to that some thienopyrimidines have been shown to posses a variety of pharmacological activities like antiviral activity [6] and were used as local anesthetic, as antiarrhythmic, as antiinflammatory and as ananalgesic [7]. Within this context and also, as a part of our work dealing with the synthesis of heterocyclic containing pyridazine ring[8–12] we were interested in the synthesis

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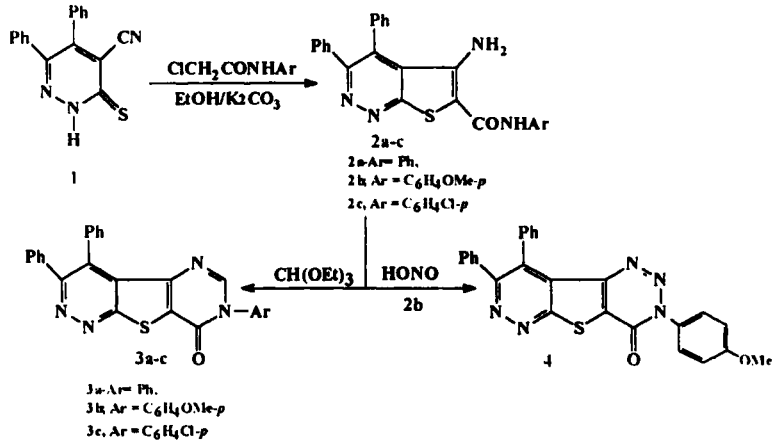
of polyfused heterocyclic containing thieno[2,3-c] pyridazine moiety with expected biological activities.

RESULTS AND DISCUSSIONS

In this paper, a new thieno[2,3-c]pyridazine derivatives (**2a-c**) were synthesized via the reaction of 4-cyano-5,6-diphenylpyridazine-3(2H)-thione (**1**) with N-substituted chloroacetamide in refluxing ethanol in the presence of anhydrous K_2CO_3. When the latter compounds were allowed to react with triethyl orthoformate, nitrous acid in cold acetic acid afforded pyrimidothienopyridazine, pyridazothienotriazine derivatives **3a-c** and **4b** respectively.

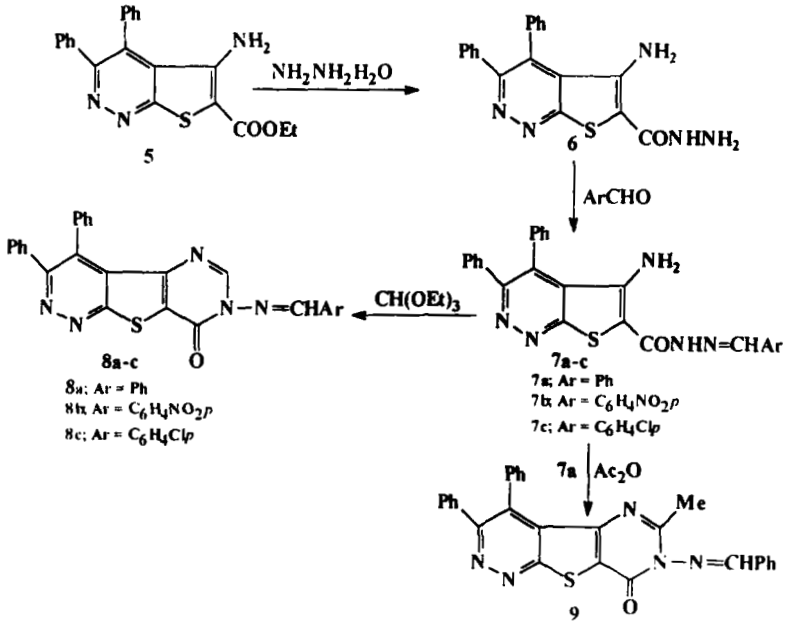
When, ethyl 3-amino-4,5-diphenylthieno[2,3-c]pyridazine-2-carboxylate **5** was allowed to react with hydrazine hydrate in refluxing ethanol, the corresponding carbohydrazide **6** was obtained. Refluxing compound **6** with aromatic aldehydes in equimolar ratio gave aryledine carbohydrazone derivatives **7a-c**. A new series of pyrimidothienopyridazine derivatives **8a-c** and **9** were synthesized via the reaction of compounds **7a-c** with triethyl ortoformate or with acetic anhydride respectively.



SCHEME 1

Refluxing each of compounds **7a-c** with CS_2/pyridine for prolonger time gave 3–4-diphenyl-8-oxopyridazo[3′,4′:4,5]thieno[2,3-d][1.3]thiazine-

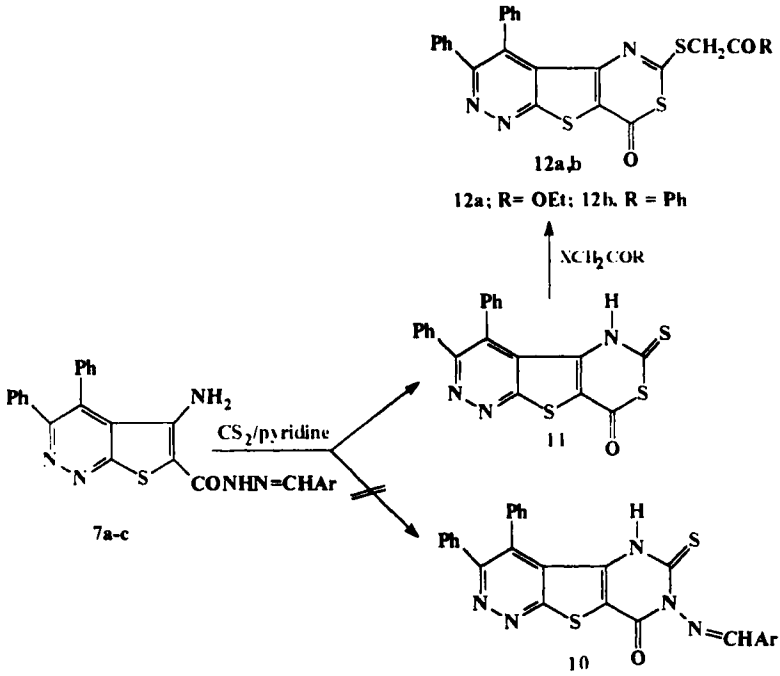
6(5H)-thione (**11**) instead of expected pyrimido-thienopyridazine **10** [13]. S-Alkylation of compound **11** with ethyl chloroacetate and phenacyl bromide in ethanol in the presence of anhydrous sod. acetate furnished the S-alkylated products **12a,b** respectively.



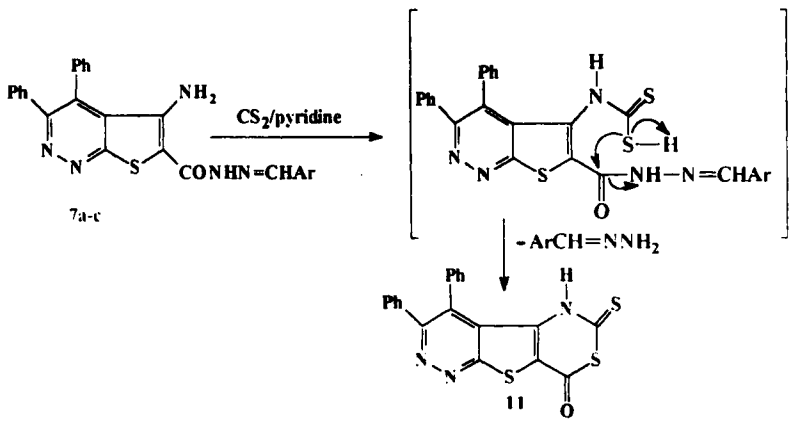
SCHEME 2

The mechanism of the formation of pyridazothienothiazine **11** was proceded via attacking of carbon disulfide to give the corresponding dithiocarbamic acid as intermediate followed by attack of the thiol group on the carbonyl group accompained by the departure of arylidenehydrazone and the formation of the pyridazothienothiazine. The formation of arylidenehydrazone were identified in the mother liquor by monitoring by TLC and using authentic samples[14].

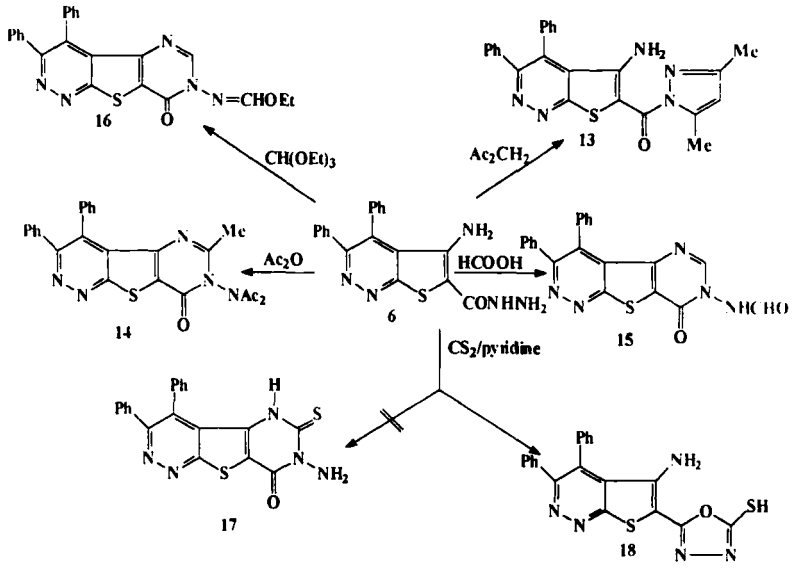
Condensation of **6** with acetyl acetone in refluxing ethanol afforded 3-amino-2-[3.5-dimethyl-1-pyrazolyl]carbonyl-4,5-diphenylthieno-[2,3-c] pyridazine (**13**). Morever, refluxing of compound **6** with acetic anhydride, formic acid and triethyl orthoformate gave the pyrimidinone derivatives



SCHEME 3



14–16 respectively. Furthermore, refluxing of the carbohydrazide **6** with CS_2/pyridine afforded oxadiazolyl derivative **18** instead of the expected pyrimidothienopyridazine **17**.

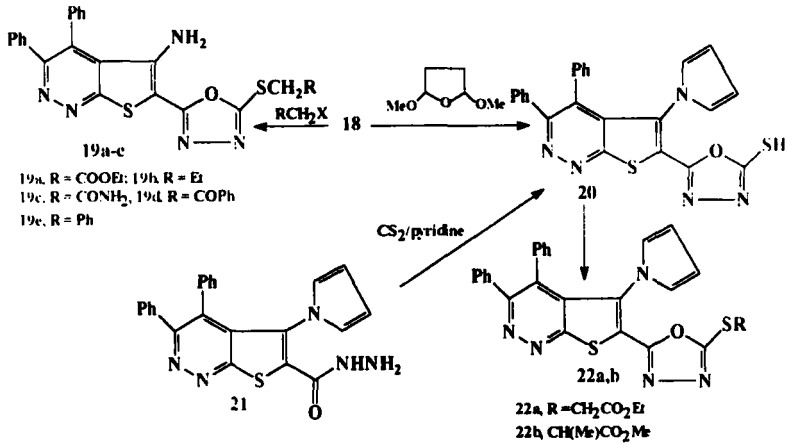


SCHEME 4

Alkylation of compound **18** with ethyl chloroacetate in ethanol in the presence of sod. acetate gave the S-alkyl derivative **19a-e**. Heating of compound **18** with 2,5-dimethoxytetrahydrofuran in acetic acid yielded the pyrrolyl derivative **20**. The latter compound was synthesized using an alternative route by the reaction of 4,5-diphenyl-3-[1-pyrrolyl]thieno[2,3-c]pyridazine-2-carbohydrazide (**21**) with CS_2/pyridine[15]. Alkylation of compound **20** with α-haloesters in ethanol in the presence of sod. acetate gave the S-alkyl products **22a,b**.

EXPERIMENTAL

All melting points are uncorrected and were measured on a Fisher-John melting point apparatus. IR spectra: Shimadzu 470 IR -spectrophotometer KBr; υ_{max} in cm^{-1}); ^1H NMR spectra: Varian EM-390 90 MHz spectrometer. *TMS*as the internal standard (δ in ppm); elemental analyses: Perkin-Elmer 240C elemental analyser. The results of the analysis were in good agreement with the calculated values.



SCHEME 5

4-Cyano-5,6-diphenylpyridazine-3(2H)-thione (1)

Prepared according to the literature procedure [16].

3-amino-4,5-diphenylthieno[2,3-c]pyridazine-2-arylcarboxamid (2a-c)

A mixture of pyridazinthione **1** (2.93 g, 0.01 mol), appropriate chloroacetanilide (0.01 mol) and anhydrous K_2CO_3(2 g)in absolute ethanol (30 ml) was heated under reflux for 2h, then allowed to cool. The solid product was collected, washed several times with water and recrystallized from ethanol to afford **2a-c** as yellow crystals. The physical constants and spectral data are listed in table I

Pyrimido[4′,5′:4,5]thieno[2,3-c]pyridazine derivative (3a-c)

To a mixture of 2a-c (1g) and triethyl orthoformate (5 ml), drops of acetic acid was added. The mixture was heated under reflux for 1 h. The solid product was collected and recrystallized from acetic acid. The physical constants and spectral data of compounds 3a-c are listed in table I.

3-Aryl-8.9-diphenylpyridazo[3′,4′:5,4]thieno[3,2-d]triazine (4)

To a compound 2 (0.005 mol) dissolved in acetic acid (20ml), sodium nitrite solution (0.5 g in 2 ml H_2O) was added drop by drop with stirring during 15 minutes. After the addition was finistred stirring was continued for additional one hour and then allowed to stand for 8 h. The solid product was collected and recrystallized from acetic acid as pale yellow crystals in 72% yield, m.p 260°C decomposed.

Ar= $C_6H_4OCH_3$-p: Anal Calcd. for: $C_{26}H_{17}N_5O_2S$ (463.51): C. 67.37; H, 3.70; N, 15.11; S, 6.92% Found: C, 67.17; H, 3.94; N, 14.94; S, 7.00%; IR: $\nu = 1660\ cm^{-1}$ (CO). ^{1}HNMR(DMSO-d_6): 3.2 (s, 3H, CH_3), 7.2–7.8, m, 14H, ArH).

Ethyl 3-amino-4,5-diphenylthieno[2,3-c]pyridazine-2-carboxylate (5)

Prepared according to the literature procedure [16]

3-amino-4,5-diphenylthieno[2,3-c]pyridazine-2-carbohydrazide (6)

A mixture of thienopyridazine carboxylate **5** (2g) and hydrazine hydrate (5 ml, 85%) in ethanol (30 ml) was refluxed for 5h. The solid product precipitated on hot was separated by filtration, washed well with ethanol and recrystallized from dioxan as yellow crystals in 87% yield, m.p. 287 °C Anal. Calcd. for $C_{19}H_{15}N_5OS$(361.42): C, 63.14, H, 4.18, N, 19.38, 8.87%. Found: C, 62.92, H, 3.94, N, 19.18, 9.04%.; IR: $\nu = 3310$, 3300, 3230 cm^{-1} ($NHNH_2$), and 1620 cm^{-1} (CO).

2-Aryledinecarbohydrazone-3-amino-4,5-diphenylthieno[2,3-c] pyridazine (7a-c)

A mixture of thienopyridazine carbohydrazide **6** (3.6g 0.01 mol) and appropriate aromatic aldehyde (0.01 mol) in ethanol (30 ml) was refluxed for 2h. Then allowed to cool. The solid product was collected and recrystallized from acetic acid. The physical constants and spectral data of compounds **7a-c** are listed in table I.

TABLE I Physical Constants and Spectral Data of Compounds 2a-c,3a-c,7a-c and 8a-c

m.p. (°C) Yield%	Formula M.Wt.	Analytical Data Calcd./found				Spectral Data
		C	H	N	S	
237	$C_{25}H_{18}N_4OS$ (422.50)	71.07 71.00	4.29 4.52	13.26 13.08	7.59 7.72	IR:3470.3300.3200cm^{-1}(NH.NH$_2$). 1635 cm^{-1} (C=O). ^{1}HNMR (DI d$_6$): δ = 5.6 (s,2H.NH$_2$),7.2–7.6(m. 15H, ArH), 7.8 (s. 1H, NH)
263	$C_{26}H_{20}N_4O_2S$ (452.53)	69.01 68.88	4.45 4.62	12.38 12.30	7.08 6.88	IR: 3440.3300.3200cm^{-1}(NH, NH$_2$), 1630 cm^{-1} (C=O).
297	$C_{25}H_{17}ClN_4OS$ (456.95)	65.71 65.88	3.75 4.00	12.26 12.06	7.02 6.80	IR: 3450,3350,3200cm^{-1}(NH, NH$_2$), 1635 cm^{-1} (C=O).
>300	$C_{26}H_{16}N_4OS$ (432.50)	72.20 72.00	3.73 4.02	12.95 13.16	7.41 7.66	IR: 1670 cm^{-1} (C=O), ^{1}HNMR (DMSO-d$_6$): δ = 7.1–7.6(m, 15H, A 8.6 (s, 1H, CH pyrimidine).
>300	$C_{27}H_{18}N_4O_2S$ (462 53)	70.11 69.98	3.92 3.82	12.11 12.00	6.93 6.98	IR: 1670 cm^{-1} (C=O
>300	$C_{26}H_{15}ClN_4OS$ (466.94)	66.88 67.04	3.24 3.06	12.00 11.88	6.87 7.08	IR: 1675 cm^{-1} (C=O), ^{1}HNMR (DMSO-d$_6$): δ = 7.2–7.6(m, 14H, A 8.7 (s, 1H, CH pyrimidine)
300 (78)	$C_{26}H_{19}N_5OS$ (449.53)	69.47 69.62	4.26 4.52	15.58 15.72	7.13 7.00	IR: 3470,3300,3170cm^{-1}(NH$_2$, 1625 cm^{-1} (C=O), ^{1}HNMR (DMSO δ = 6.1(s,2H-NH$_2$),7.2–7.6(m, 15H, ArH), 8.3 (s, 1H, N=CH), 9.3(s 1H,NH).
300 (78)	$C_{26}H_{18}N_6O_3S$ (494.53)	63.15 62.92	3.67 3.88	16.99 17.22	6.48 6.72	IR: 3470,3300,3180cm^{-1}(NH$_2$),),1630 cm^{-1} (C=O).
300 (78)	$C_{26}H_{18}ClN_5OS$ (483.97)	64.53 64.32	3.75 4.00	14.47 14.70	6.62 6.78	IR:3455,3330,3160cm^{-1}(NH),1630 cm^{-1}(C=O).
300 (78)	$C_{27}H_{17}N_5OS$ (459.52)	70.57 70.72	3.73 4.00	15.24 15.48	6.98 7.16	IR: 1670cm^{-1} (C=O); ^{1}HNMR (DMSO- d$_6$):δ=7.3–7.7(m,15H,ArH) 1H, N=CH), 9.1(s, 1H,CH pyrimidine).

Comp. (°C) Yield%	*Formula M.Wt.*	*Analytical Data Calcd./found*				*Spectral Data*
		C	*H*	*N*	*S*	
300 (78)	$C_{27}H_{16}N_6O_3S$ (504.52)	64.28 64.38	3.20 3.44	16.66 15.46	6.35 6.34	IR: 1675 cm^{-1} (C=O).
300 (78)	$C_{27}H_{16}ClN_5OS$ (493.97)	65.65 65.45	3.26 3.04	14.18 14.00	6.49 6.72	IR: 1675 cm^{-1} (C=O.

cd = 7.76; Found: 8.00
cd = 7.59; Found: 7.72
cd = 7.33; Found: 7.08
cd = 7.18; Found: 6.9

Pyrimido[4′,5′:4,5]thieno[2,3-c]pyridazine derivatives (8a-c)

The title compounds were prepared similar to the procedure reported in the preparation of compounds 3a-c. The physical constants and spectral data of compounds **8a-c** are listed in table I.

3,4-Diphenyl-6-methyl-7-benzyledineamino-8-oxopyrimido[4′,5′:4,5] thieno[2,3-c] pyridazine (9)

A sample of compound **7a** (0.5 g) in acetic anhydride (10 ml) was heated under reflux for 5h, Then allowed to cool. The solid product was filtered off and recrystallized from acetic acid as pale yellow in 81% yield, m.p. > 300 °C.

Anal. Calcd. for $C_{28}H_{19}N_5OS$(473.55): C, 71.02, H, 4.04; N, 14.79; S, 6.77%. Found: C, 70.82. H, 4.24; N, 15.02; S, 7.00%; IR: ν = 1680 cm^{-1} (CO), and 1600 cm^{-1}(C=N); ^{1}HNMR(CF_3CO_2D): δ-2.9 (s, 3H, CH_3), 7.2–7.7 (m, 16H, ArH+ 1 CH azomethine).

3,4-Diphenyl-8-oxopyridazo[3′,4′:4,5]thieno[2,3-d][1,3]thiazin-6(5H)thione(11)

A mixture of each 2-Aryledinecarbohydrazone-3-amino-4,5-diphenyl-thieno[2,3-c]pyridazine (**7a-c**) (3g) and carbon disulfide (2 ml) in pyridine (20 ml) was heated on water bath for 50 h. then allowed to cool. The solid product was collected and recrystallized from dioxan as yellow crystals in 65% yield, m.p. 257°C; IR: ν = 3310(NH), 1685 cm^{-1} (CO).; Anal. Calcd. for $C_{20}H_{11}N_3OS_3$:(405.51):): C, 59.24, H, 2.73; N, 10.36; S, 23.72 %. Found: C, 59.46, H, 3.00; N, 10.18; S, 23.54 %.

6-Alkylthio-3,4-diphenyl-8-oxopyridazo[3′,4′:4,5]thieno[2,3-d][1,3] thiazine(12a,b)

A mixture of compound **11** (0.01 mol), α-halocompound (0.01 mol) and sodium acetate (0.012 mol) in ethanol (30 ml) was heated under reflux for 5 h, then allowed to cool. The solid product was collected by filtration, washed well with water and recrystallized from ethanol as yellow crystals of **12a,b.**, ***12a***: R = COOEt. Produced in 78% yield. m.p. 213°C.

Anal. Calcd. for $C_{24}H_{17}N_3O_3S_3$:(491.60):):C, 58.64, H, 3.49; N, 8.55; S, 19.56 %. Found: C. 58.80; H, 3.72: N, 8.32; S, 19.76

IR: ν = 1710, 1695 cm^{-1} (2CO), ^{1}HNMR($CDCl_3$): δ = 1.1 (t, 3H, CH_3), 4.2 (s, 2H, CH_2), 4.3–4.45 (q, 2H, CH_2), 7.2–7.5 (m, 10H, ArH).

12b: R = COPh, Produced in 72% yield, m.p. 239°C.

Anal. Calcd. for $C_{27}H_{17}N_3O_2S_3$ (511.63): C, 63.38, H, 3.35; N, 8.21; S, 18.80 %. Found: C, 63, 32; H, 3.52; N, 8.00; S, 19.04 %. IR: ν = 1670, 1650 cm^{-1}(2CO). ^{1}HNMR(DMSO-d_6): δ = 4.1 (s, 2H, CH_2), 7.2–7.7 (m, 15H, ArH).

3-amino-2-[3,5-dimethyl-1-pyrazolyl]carbonyl-4,5-diphenylthieno-[2,3-c]pyridazine (13)

A sample of compound **6** (0.5 mol) and acetylacetone (2 ml) was heated under reflux for 3h, then ethanol(10 ml) was added and the reflux was continued for 2 h, then allowed to cool. The solid product was collected and recrystallized from ethanol as yellow crystals in 73% yield, m.p. 257°C.

Anal. Calcd. for $C_{24}H_{19}N_5OS$(425.51): C, 67.75, H, 4.50; N, 16.46; S, 7.53 %. Found: C, 67.55, H, 4.32; N, 16.64; S, 7.72 %. IR. ν = 3440,3330 cm^{-1} (NH_2) and 1650 cm^{-1} (CO) ^{1}HNMR(DMSO-d_6) δ=2.3(s, 3H, CH_3), 2.6(s, 3H, CH_3), 6.2(s, 2H, NH_2),6.4 (s, 1H, CH pyrazole), 7.2–7.5 (m, 10H, ArH).

3,4-Diphenyl-6-methyl-7-diacetylamino-8-oxopyrimido[4′,5′:4,5] thieno[2,3-c] pyridazine (14)

A sample of compound **6** (0.5 g) was refluxed with acetic anhydride (10 ml) for 3h, then allowed to cool, then poured into cold water. The solid product was collected and recrystallized from ethanol as pale yellow crystals in 73% yield, m.p. 273°C.

Anal. Calcd. for $C_{25}H_{19}N_5O_3S$(469.52): C, 63.95, H, 4.08; N, 14.92; S, 6.83 %. Found: C, 64.16, H, 3.88; N, 15.08; S, 7.00 %.

IR: ν = 1740 cm^{-1} (2CO), and 1680 cm^{-1}(CO).

^{1}HNMR($CF3CO_2D$): δ = 2.2 (s, 3H, CH_3), 2.4 (s, 6H, CH_3), 7.3–7.6 (m, 10H, ArH).

3,4-Diphenyl-7-formylamino-8-oxopyrimido[4′,5:4,5]thieno[2,3-c] pyridazine (15)

A sample of compound **6** (0.5 g) was refluxed with formic acid (10 ml) for 2h, then allowed to cool. The solid product was collected and recrystallized from ethanol as pale yellow crystals in 76% yield. m.p. 284°C.

Anal. Calcd. for $C_{21}H_{13}N_5O_2S$(399.43): C, 63.15, H, 3.28; N, 17.53; S. 8.03 %. Found: C, 62.92, H, 3.08; N, 17.73; S, 7.84 %.

IR: $\nu = 3380$ cm^{-1} (NH), and 1680 cm^{-1}(2CO). ^{1}HNMR($CF3CO_2D$): $\delta = 7.2–7.5$ (m, 10H, ArH), 8.3 (s, 1H, CHO) and 8.5 (s, 1H, CH pyrimidine).

3,4-Diphenyl-7-ethoxymethyleneamino-8-oxopyrimido[4′,5:4,5] thieno[2,3-c] pyridazine (16)

A sample of compound **6** (0.5 g) and triethyl orthoformate(10 ml) was refluxed for 4h, then allowed to cool. The solid product was collected and recrystallized from ethanol as pale yellow crystals in 67% yield, m.p. 281°C.

Anal. Calcd. for $C_{23}H_{17}N_5O_2S$(427.48): C, 64.62, H, 4.01; N, 16.38; S, 7.50 %. Found: C, 64.46, H, 3.84; N, 16.56; S, 7.74%.

IR: $\nu = 1670$ cm^{-1}(CO) and 1600 cm^{-1}(C=N). ^{1}HNMR(DMSO-d_6): $\delta = 1.1$ (t, 3H, CH_3), 4.2–4.4 (q, 2H, CH_2), 7.2–7.5 (m, 10H, ArH) 8.3 (s, 1H, N=CH) and 8.5 (s, 1H, CH pyrimidine).

3-Amino-2-[2-mercaptooxadiazol-5-yl]-4,5-diphenylthieno[2,3-c] pyridazine (18)

A sample of compound **6** (0.5 g) and carbon disulfide (2 ml) in pyridine (20 ml) was refluxed for 4h. on steam bath.. The solid product was collected and recrystallized from dioxane as orange crystals in 62% yield, m.p. > 300°C.

Anal. Calcd. for $C_{20}H_{13}N_5OS_2$(403.48): C, 59.54, H, 3.25; N, 17.36; S, 15.89 %.

Found: C, 59.72, H, 3.05; N, 17.12; S, 16.08 %.

IR: $\nu = 3420, 3320$ (NH_2) cm^{-1} and 2900 –2700 cm^{-1}(SH).

TABLE II Physical Constants and Spectral Data of Compounds 19a-e

	M.P. °C	M.P. Mol. Formula (Mol. Wt)	Analytical Data Calcd./Found				Spectral Data
			C	H	N	S	
OEt	159	$C_{24}H_{19}N_5O_3S_2$ (489.57)	58.88 59.04	3.91 4.12	14.31 14.12	13.10 13.00	IR: ν = 3450,3320 (NH_2) cm^{-1} and 1730, ^{1}HNMR($CDCl_3$): δ = 1.3(t, 3H, CH_3), 3.9(s, 2H, CH_2), 4.0–4.2 (q, 2H, CH_2), 5.5 (s, NH_2)7.2–7.6(m, 10H, ArH).
	168	$C_{22}H_{17}N_5OS_2$ (431.53)	61.23 60.95	3.97 4.16	16.23 16.08	14.86 15.04	IR: ν = 3450, 3320 cm^{-1} (NH_2) ^{1}HNMR($CDCl_3$): δ = 1.1–1.3 (CH_3), 3.5–3.7 (q, 2H, CH_2), 5.5 (s, 2H, NH_2), 7.2–7.6 (m, 10H
NH_2	272	$C_{21}H_{14}N_6O_2S_2$ (446.50)	56.49 56.72	3.16 3.34	18.82 19.02	14.36 14.52	IR: ν = 3450, 3340, 3250 ($2NH_2$) cm^{-1} and, 1670 cm^{-1} (CO).
Ph	194	$C_{28}H_{19}N_5O_2S_2$ (521.61)	64.47 64.63	3.67 3.72	13.43 13.16	12.29 12.09	IR: ν = 3450, 3320 (NH_2) cm^{-1} and 1680 cm^{-1} (CO). ^{1}HNMR($CDCl_3$): δ = 4.6 (s, 2H, CH_2), 5.4 (s, 2H, NH_2), 7.3–7 15H, ArH).
n	191	$C_{27}H_{19}N_5OS_2$ (493.60)	65.70 65.86	3.88 4.04	14.19 14.00	12.99 13.22	IR: ν = 3450, 3320 (NH_2) cm^{-1} ^{1}HNMR($CDCl_3$): δ = 4.2 (s, 2 CH_2), 5.4 (s, 2H, NH_2), 7.3–7.8 (m, 15H, ArH).

3-Amino-2-[2-alkylmercaptooxadiazol-5-yl]-4,5-diphenylthieno[2,3-c] pyridazine (19a-e)

A mixture of compound **18** (0.01 mol), a-halocompounds (0.01 mol) and sodium acetate (0.012 mol) in ethanol (30 ml) was heated under reflux for 5 h, then allowed to cool. The solid product was collected by filtration, washed well with water and recrystallized from ethanol as yellow crystals The physical constants and spectral data of compounds **19a-e** are listed in table II.

3-[pyrol-1-yl]-2-[2-mercaptooxadiazol-5-yl]-4,5-diphenylthieno[2,3-c] pyridazine (20)

Method A

A mixture of compound 18 (0.01 mol), and 2,5-dimethoxytetrahydrofuran (0.01 mol) in acetic acid (20 ml) was heated under reflux for 2 h. Then allowed to cool, the solid product was collected and recrystallized from acetic acid as yellow crystals in 74% yield, m.p.>300°C.

Method B

A mixture of compound 21 (0.01 mol), and CS_2(2 ml) in pyridine (20 ml) was heated on steam bath for 12 h, then allowed to cool, the solid product was collected and recrystallized from acetic acid as yellow crystals in 74% yield, m.p.> 300 °C.

Anal. Calcd. for $C_{24}H_{15}N_5OS_2$: (453.54): C, 63.56, H, 3.33; N, 15.44; S, 14.14%. Found: C, 63.78; H, 3.10; N, 15.32; S, 14.00%.

IR: ν = 2930–2730 cm^{-1} (SH).

3-[pyrol-1-yl]-2-[2-alkylmercaptooxadiazol-5-yl]-4,5-diphenylthieno[2,3-c] pyridazine (22a,b)

A mixture of compound **20** (0.01 mol), α-halocompounds (0.01 mol) and sodium acetate (0.012 mol) in ethanol (30 ml) was heated under reflux for 2 h, then allowed to cool. The solid product was collected by filtration, washed well with water and recrystallized from ethanol as yellow crystals. **22a**: Produced in 75% yield, m.p. 163°C.

Anal. Calcd. for $C_{28}H_{21}N_5O_3S_2$: (539.63): C, 62.32, H, 3.92; N, 12.98; S, 11.88%. Found: C, 62.56, H, 3.72; N, 13.18; S, 12.06 %.

IR: ν = 3450, 3320 (NH_2) cm^{-1} and 1730, 1695 cm^{-1} (CO).

22b: Anal. Calcd. for $C_{28}H_{21}N_5O_3S_2$ (539.63): C, 62.32, H, 3.92; N, 12.98; S, 11.88 %.: Found: C, 62.54, H, 3.82; N, 13.12; S, 12.08 %.:

IR: ν = 1730, 1695 cm^{-1} (CO). ^{1}HNMR($CDCl_3$): δ = 3.3 (d, CH-$\underline{CH_3}$), 3.4–3.5 (q,1H,CH), 3.6 (s, 3H, CH_3), 5.3–5.5 (m, 2H, 2CH – pyrrol),), 5.7–5.9(m, 2H, 2CH-pyrrol), 7.1–7.6 (m, 10H, ArH).

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