Monatshefte für Chemie 126, 953–959 (1995)

Monatshefte für Chemie
Chemical Monthly

Synthesis of New Fused Heterocycles by Annelation of Thiopyrano[4′,3′:4,5]thieno[2,3-*c*]pyrimidines†

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Summary. Appropriately substituted thieno[2,3-*c*]thiopyrans (**2**, **3**, **5**, **6**, **10**, **11**) were converted into 1,5,6,8-tetrahydro-2*H*-thiopyrano[4′,3′:4,5]thieno[2,3-*d*]pyrimidin-4(3*H*)-ones (**4**, **7**, **12**). These in turn were used as key intermediates for annelations of thiazolo and 1,3-thiazino moieties to yield the tetracyclic target structures **7**, **8**, **9**, and **13**, derived from two novel heterocyclic ring systems.

Keywords. Fused S,N-heterocycles; Thieno[2,3-*c*]thiopyrans; 1,5,6,8-Tetrahydro-2*H*-thiopyrano[4′,3′:4,5]thieno[2,3-*d*]pyrimidin-4(3*H*)-ones; Thiazolo[3,2-*a*]thiopyrano[4′,3′:4,5]thieno[2,3-*d*]pyrimidin-5-ones; 2*H*,6*H*,8*H*-Thiopyrano[4″,3″:4′,5′]thieno[2′,3′:4,5]pyrimido[2,1-*b*][1,3]thiazin-6-one.

Synthese neuer kondensierter Heterocyclen durch Anellierung von Thiopyrano[4′,3′:4,5]thieno[2,3-*c*]pyrimidinen

Zusammenfassung. Entsprechend substituierte Thieno[2,3-*c*]thiopyrane (**2**, **3**, **5**, **6**, **10**, **11**) wurden in 1,5,6,8-Tetrahydro-2*H*-thiopyrano[4′,3′:4,5]thieno[2,3-*d*]pyrimidin-4(3*H*)-one (**4**, **7**, **12**) umgewandelt, welche als Schlüssel-Zwischenprodukte für Thiazol- und 1,3-Thiazin-Anellierungen zu den tetracyclischen Zielstrukturen **7**, **8**, **9** und **13** dienten; diese leiten sich von zwei neuen heterocyclischen Ringsystemen ab.

Introduction

Within the last years, a lot of work was invested into synthetic approaches leading to novel S,N-heterocyclic systems [1, 2]. The present paper reports on various ways leading to appropriately substituted thieno[2,3-*c*]thiopyrans (**2**, **3**, **5**, **6**, **10**, **11**) and 1,5,6,8-tetrahydro-2*H*-thiopyrano[4′,3′:4,5]thieno[2,3-*d*]pyrimidin-4(3*H*)-ones (**4**, **7**, **12**) which proved to be useful intermediates for the synthesis of derivatives (**7**, **8**, **9**, and **13**) of the two novel tetracyclic ring systems **A** and **B**, obtained by fusion of thiazolo and 1,3-thiazino moieties (parent system skeleton: Fig. 1).

Results and Discussion

Reaction of the amino ester **2** (obtained by *Gewald* reaction of **1** [8]) with ethoxy carbonylisothiocyanate [9, 10] in acetone gave the thiourea derivative **3** which was

† Dedicated to Professor Dr. *F. Sauter* on the occasion of his 65th birthday

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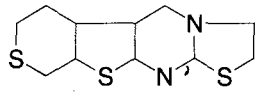
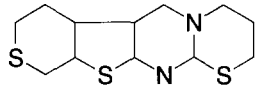


A

Thiazolo[3,2-*a*]thiopyrano[4′,3′:4,5]thieno[2,3-*d*]pyrimidine



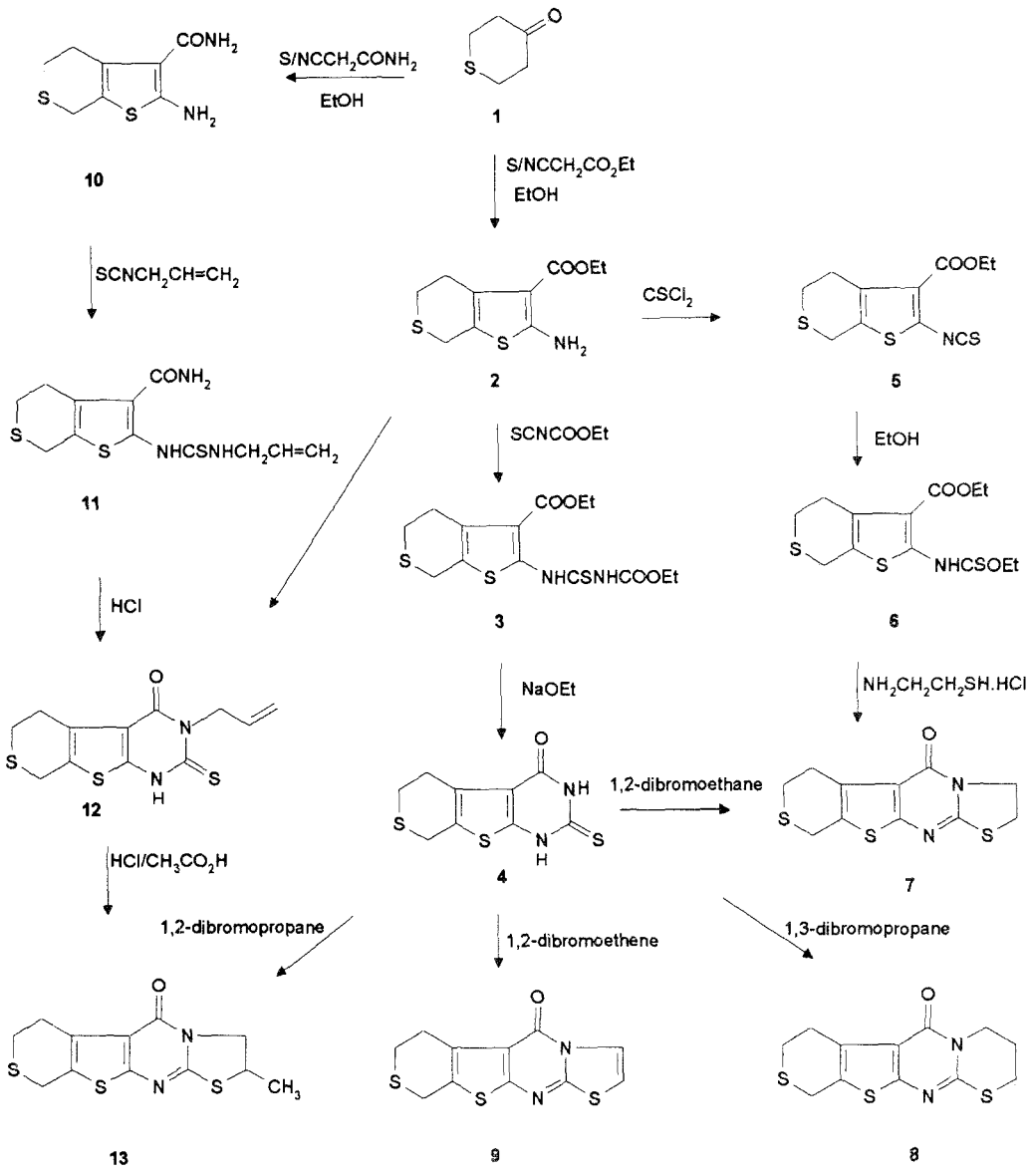
B

Thiopyrano[4″,3″:4′,5′]thieno[2′,3′:4,5]pyrimido[2,1-*b*][1,3]thiazine

Fig. 1. Parent system skeletons of compounds **7**, **8**, **9**, and **13**

cyclized in the presence of sodium ethoxide to give 2-thioxo-1,5,6,8-tetrahydro-2*H*-thiopyrano[4′,3′:4,5]thieno[2,3-*d*]pyrimidin-4(3*H*)-one (**4**). An ensuing reaction of **4** with 1,2-dibromoethane afforded 2,3,6,9-tetrahydro-5*H*,7*H*-thiazolo[3,2-*a*]thiopyrano[4′,3′:4,5]thieno[2,3-*d*]pyrimidin-5-one (**7**). Similarly, the condensation of **4** with 1,3-dibromopropane and 1,2-dibromoethene yielded the corresponding 3,4,7,10-tetrahydro-2*H*,6*H*,8*H*-thiopyrano[4″,3″:4′,5′]thieno[2′,3′:4,5]pyrimido[2,1-*b*]·[1,3]thiazin-6-one (**8**) and 6,9-dihydro-5*H*,7*H*-thiazolo[3,2-*a*]thiopyrano[4′,3′:4,5]thieno[2,3-*d*]-pyrimidin-5-one (**9**), respectively. Compound **7** was also prepared *via* conversion of **2** into 2-isothiocyanato-4,7-dihydro-5*H*-thieno[2,3-*c*]-thiopyran-3-carboxylic acid ethyl ester (**5**) by reaction with thiophosgene in a mixture of water and dichloromethane (two-phase system) which allows an easy separation and isolation of isothiocyanate **5** from the reaction mixture. Since this compound contains two reactive groups adjacent to each other, it is a versatile intermediate for ensuing annelations to fused heterocyclic systems. Compound **5**, stable toward alcohols at room temperature, reacted with anhydrous ethanol at elevated temperature and prolonged reaction time to give the corresponding 2-((ethoxythioxomethyl)-amino)-4,7-dihydro-5*H*-thieno[2,3-*c*]thiopyran-3-carboxylic acid ethyl ester (**6**) which was converted to **7** by reaction with aminoethanthiol hydrochloride in anhydrous pyridine.

An alternative route to fused tetracyclic thiazolo compounds was found in reacting **2** with allylisothiocyanate in presence of morpholine, yielding 3-(2-propenyl)-2-thioxo-1,5,6,8-tetrahydro-2*H*-thiopyrano[4′,3′:4,5]thieno[2,3-*d*]pyrimidin-4(3*H*)-one (**12**), and by subsequent treatment of **12** with a mixture of hydrochloric acid and acetic acid. Thus, the target product 2-methyl-2,3,6,9-tetrahydro-5*H*,7*H*-thiazolo-[3,2-*a*]thiopyrano[4′,3′:4,5]thieno[2,3-*d*]pyrimidin-5-one (**13**) was obtained, the structure of which was unambiguously confirmed by identification with an authentic sample prepared *via* reaction of compound **4** with 1,2-dibromopropane. Compound **12**, the key intermediate of this alternative route, was also prepared from 2-amino-4,7-dihydro-5*H*-thieno[2,3-*d*]thiopyran-3-carboxamide (**10**, [8]) by reaction with



Scheme 1

allylisothiocyanate in acetonitrile/ethanol (1:4) to give 2-(((2-propenyl)-amino-thioxomethyl)-amino)-4,7-dihydro-5*H*-thieno[2,3-*c*]thiopyran-3-carboxamide (**11**) and its subsequent ring closure by ethanolic HCl.

Experimental

Melting points were determined on a Kofler melting point apparatus and are uncorrected. Elementary analyses were performed at the Microanalytical Laboratory, Institute of Physical Chemistry, University of Vienna (Mag. *J. Theiner*). ^{13}C and ^{1}H NMR spectra: Bruker AC 200 (^{1}H: 200.13 MHz, ^{13}C: 50.47 MHz), 5 mm dual $^{1}H/^{13}C$-VT-probe, 300 K; solvent: *DMSO*-d_6 and $CDCl_3$, respectively; δ values are given ppm, internal standard *TMS* ($\delta = 0$). IR spectra were recorded on a Shimadzu 470 spectrophotometer (KBr pellets).

2-Amino-4,7-dihydro-5H-thieno[2,3-c]thiopyran-3-carboxylic acid ethyl ester (**2**, [3])

A suspension of sulfur (3.2 g, 0.1 mol), ethylcyanoacetate (11.3 g, 0.01 mol), and tetrahydrothiopyran-4-one (**1** [11]; 11.6 g, 0.1 mol) in morpholine (13 ml) and ethanol (40 ml) was heated at 50 °C for one hour. The product crystallized after cooling. The yellow precipitate was filtered and washed with ethanol and dried. The filtrate was concentrated to yield a second fraction; combined yield 20 g (82.3%) of **2** as yellow crystals. M.p.: 87–89 °C; $C_{10}H_{13}NO_2S_2$ (243.32); calc.: C: 49.35, H: 5.38, N: 5.75; found: C: 49.29, H: 5.31, N: 5.55; ^{1}H NMR ($CDCl_3$): 1.30 (t, 3H, $COOCH_2CH_3$), 2.80 (t, 2H, H-4), 3.00 (t, 2H, H-5), 3.60 (s, 2H, H-7), 4.30 (q, 2H, $COOCH_2CH_3$), 6.00 (s, 2H, NH_2); ^{13}C NMR ($CDCl_3$): 14.32 (q, OCH_2CH_3), 25.01 (t, C-4), 25.97 (t, C-5), 28.56 (s, C-7), 59.47 (t, OCH_2CH_3), 105.80 (s, C-3), 113.41 (s, C-7a), 132.10 (s, C-3a), 161.02 (s, $COOCH_2CH_3$), 165.69 (s, C-2).

2-((Ethoxycarbonylaminothioxomethyl)-amino)-4,7-dihydro-5H-thieno[2,3-c]-thiopyran-3-carboxylic acid ethyl ester (**3**)

A solution of ethoxycarbonyl isothiocyanate [4, 5] (prepared by mixing ethylchloroformate (1.08 g, 0.01 mol) in dry acetone with ammonium thiocyanate (0.76 g, 0.01 mol) and heating in a water bath for 20 min) was added to a stirred solution of compound **2** (2.4 g, 0.01 mol) in acetone (30 ml). The whole mixture was heated under reflux in a water bath for 2 hours and then evaporated *in vacuo*. The remaining product was triturated with ethanol and then collected by filtration, dried, and recrystallized from ethanol to give **3** (70% yield) as yellow crystals. M.p.: 175–176 °C; $C_{14}H_{18}N_2O_4S_3$ (374.49); calc.: 44.89, H: 4.84, N: 7.48; found: C: 45.03, H: 4.56, N: 7.63; ^{1}H NMR ($CDCl_3$): 1.30 (m, 6H, 2 $COOCH_2CH_3$), 2.90 (t, 2H, H-4), 3.20 (t, 2H, H-5), 3.70 (s, 2H, H-7), 4.40 (m, 4H, 2 $COOCH_2CH_3$), 8.10 (s, 1H, NH), 14.10 (s, 1H, NH); ^{13}C NMR ($CDCl_3$): 14.12 (q, OCH_2CH_3), 14.22 (q, OCH_2CH_3), 25.13 (t, C-4), 26.17 (t, C-5), 27.92 (s, C-7), 60.83 (t, OCH_2CH_3), 62.94 (t, OCH_2CH_3), 116.16 (s, C-3), 123.78 (s, C-7a), 131.07 (s, C-3a), 146.84 (s, $COOCH_2CH_3$), 151.21 (s, $COOCH_2CH_3$), 164.99 (s, C-2), 173.39 (s, C=S).

2-Thioxo-1,5,6,8-tetrahydro-2H-thiopyrano[4',3':4,5]thieno[2,3-d]pyrimidin-4(3H)-one (**4**)

Compound **3** (3.7 g, 0.0098 mol) was dissolved in a solution of sodium ethoxide (from 0.23 g of sodium and 15 ml of absolute ethanol), and the solution was heated under reflux for 30 min. The solvent was evaporated *in vacuo*, some water was added to the residue, and the *pH* of the mixture was adjusted to 4 with hydrochloric acid. The separated product was collected and crystallized from *DMF* toluene to give 1.8 g (72% yield) of **4**. M.p.: 250 °C (dec.); $C_9H_8N_2OS_3$ (256.36); calc.: C: 42.16, H: 3.14, N: 10.93; found: C: 42.32, H: 3.34, N: 11.32; ^{1}H NMR (*DMSO*-d_6): 2.90 (t, 2H, H-5), 3.10 (t, 2H, H-6), 3.70 (s, 2H, H-8), 12.30 (s, 1H, NH), 13.30 (s, 1H, NH); ^{13}C NMR (*DMSO*-d_6): 24.00 (t, C-5), 24.43 (t, C-6), 26.98 (s, C-8), 116.54 (s, C-4a), 124.47 (s, C-4b), 130.47 (s, C-8a), 149.38 (s, C-9a), 156.83 (s, C-4), 172.88 (s, C-2).

2-Isothiocyanato-4,7-dihydro-5H-thieno[2,3-c]thiopyran-3-carboxylic acid ethyl ester (**5**)

A suspension of **2** (0.78 g, 0.0032 mol) in dichloromethane (5 ml) was added to a stirred suspension of calcium carbonate (2.79 g, 0.027 mol) in water (20 ml) and dichloromethane (40 ml) at room temperature. To the stirred mixture thiophosgene (0.4 g, 0.0034 mol) was slowly added (ice bath). The temperature of the reaction mixture was left to reach room temperature; stirring was continued for 5 hours. Inorganic salts were removed by filtration, and the organic phase was separated and washed with water and 5% aqueous sodium bicarbonate. After drying over magnesium sulfate, the dichloromethane was removed under reduced pressure and the residue purified using column chromatography (silica gel, chloroform/acetone 20:1) to give 0.4 g (43.9% yield) of **5**. M.p.: 46–48 °C; $C_{11}H_{11}NO_2S_3$ (285.39); calc.: C: 46.29, H: 3.88, N: 4.90; found: C: 47.21, H: 4.77, N: 4.24; ^{1}H NMR ($CDCl_3$): 1.40 (t, 3H, $COOCH_2CH_3$), 2.90 (t, 2H, H-4), 3.10 (t, 2H, H-5), 3.70 (s, 2H, H-7), 4.40 (q, 2H, $COOCH_2CH_3$); IR (KBr): 1700 (C=O), 2100 (NCS) cm^{-1}.

3-((Ethoxythioxomethyl)-amino)-4,7-dihydro-5H-thieno[2,3-c]thiopyran-3-carboxylic acid ethyl ester (**6**)

A solution of **5** (1.0 g) in anhydrous ethanol (30 ml) was heated under reflux for 24 hours. The solvent was evaporated *in vacuo* to give 0.85 g (73.2% yield) of **6**. An analytical sample was obtained by recrystallization from ethanol as yellow crystals. M.p.: 124–126 °C; $C_{13}H_{17}NO_3S_3$ (331.46); calc.: C: 47.10, H: 5.17, N: 4.22; found: C: 46.95, H: 4.87, N: 4.11; ^{1}H NMR ($CDCl_3$): 1.40 (m, 6H, 2 $COOCH_2CH_3$), 2.90 (t, 2H, H-4), 3.10 (t, 2H, H-5), 3.60 (s, 2H, H-7), 4.40 (q, 2H, $COOCH_2CH_3$), 4.60 (q, 2H, $COOCH_2CH_3$), 12.20 (s, 1H, NH); ^{13}C NMR ($CDCl_3$): 13.91 (q, OCH_2CH_3), 14.11 (q, OCH_2CH_3), 25.11 (t, C-4), 26.10 (t, C-5), 27.98 (s, C-7), 60.76 (t, OCH_2CH_3), 66.76 (t, OCH_2CH_3) 112.87 (s, C-3), 122.04 (s, C-7a), 130.69 (s, C-3a), 148.76 (s, $COOCH_2CH_3$), 166.17 (s, C-2), 184.68 (s, CS); IR (KBr): 1520, 1560, 1650, 1660, 2990, 3100 cm^{-1}.

2,3,6,9-Tetrahydro-5H,7H-thiazolo[3,2-a]thiopyrano[4',3':4,5]thieno[2,3-d]-pyrimidin-5-one (**7**)

Method A:

1,2-Dibromoethane (1.87 g, 0.01 mol) in *DMF* (20 ml) was added dropwise to a stirred solution containing **4** (2.56 g, 0.01 mol), water (20 ml), and sodium hydroxide (0.4 g). The mixture was heated at 90 °C for one hour and then stirred at room temperature for one more hour. The solid product was washed with water and then triturated with ethanol to give a colorless solid which was crystallized from ethanol to give 1.9 g (67.3% yield) of **7**. M.p.: 201–203 °C; $C_{11}H_{10}N_2OS_3$ (282.40); calc.: C: 46.78, H: 3.56, N: 9.92; found: C: 46.72, H: 3.38, N: 9.74; ^{1}H NMR (*DMSO*-d_6): 2.80 (t, 2H, H-6), 3.10 (t, 2H, H-7), 3.60 (t, 2H, H-3), 3.80 (s, 2H, H-9), 4.40 (t, 2H, H-2); ^{13}C NMR (*DMSO*-d_6): 24.44 (t, C-6), 24.61 (t, C-7), 26.73 (s, C-9), 27.13 (t, C-2), 48.20 (t, C-3), 118.16 (s, C-5a), 126.86 (s, C-5b), 129.95 (s, C-9a), 156.24 (s, C-10a), 160.64 (s, C-11), 161.94 (s, C-5).

Method B (from compound **6***):*

To the solution of compound **6** (0.34 g, 0.001 mol) in anhydrous pyridine (10 ml), aminoethanethiol hydrochloride (0.18 g, 0.0015 mol) was added and the mixture was heated under reflux for 20 hours. The solvent was evaporated *in vacuo*, sodium hydroxide (aqueous solution, 10%, 10 ml) was added and the precipitate was collected by filtration to give 0.17 g (60.7% yield) of **7**. M.p.: 201–203 °C; the compound is identical to that obtained according to method A.

3,4,7,10-Tetrahydro-2H,6H,8H-thiopyrano[4'',3'':4',5']thieno[2',3':4,5]pyrimido[2,1-b][1,3]thiazin-6-one (**8**)

1,3-Dibromopropane (1.01 g, 0.005 mol) in *DMF* (10 ml) was added dropwise to a stirred solution containing compound **4** (1.29 g, 0.005 mol), water (10 ml), and sodium hydroxide (0.2 g). The mixture was heated at 90 °C for 2 hours and then stirred at room temperature for one more hour. The solid product was washed with water and then triturated with ethanol to give a yellow solid which was crystallized from ethanol to give yellow crystals (60% yield) of **8**. M.p.: 155–157 °C; $C_{12}H_{12}N_2OS_3$ (296.43); calc.: C: 48.61, H: 4.08, N: 9.45; found: C: 48.82, H: 4.21, N: 9.74; ^{1}H NMR (*DMSO*-d_6): 2.20 (t, 2H, H-3), 2.90 (t, 2H, H-7), 3.10 (t, 2H, H-8), 3.30 (t, 2H, H-4), 3.80 (s, 2H, H-10), 4.10 (t, 2H, H-2).

6,9-Dihydro-5H,7H-thiazolo[3,2-a]thiopyrano[4',3':4,5]thieno[2,3-d]pyrimidin-5-one (**9**)

Molar portions of **2** and 1,2-dibromoethene were treated as described for the preparation of **8**. The yield of the recrystallized compound was 58.3%. M.p.: 224–227 °C; $C_{11}H_8N_2OS_3$ (280.38); calc.: C: 47.11, H: 2.87, N: 9.99; found: C: 47.28, H: 2.92, N: 10.20; ^{1}H NMR (*DMSO*-d_6): 2.90 (t, 2H, H-6), 3.20 (t, 2H, H-7), 3.90 (s, 2H, H-9), 7.50 (d, 1H, H-3), 8.00 (d, 2H, H-2).

2-Amino-4,7-dihydro-5H-thieno[2,3-c]thiopyran-3-carboxamide (**10**, [2])

A suspension of sulfur (3.2 g, 0.1 mol), 2-cyanoacetamide (8.4 g, 0.1 mol), and tetrahydrothiopyran-4-one (**1** [6]; 11.6 g, 0.1 mol) in morpholine (10 ml) and ethanol (60 ml) was heated at 50–60 °C for 1 hour. The solid product was collected by filtration and recrystallized from *DMF*/EtOH (2:5) to give 15.0 g (70% yield) of **10** as yellow crystals. M.p.: 194–196 °C; $C_8H_{10}N_2OS_2$ (214.30); calc.: C: 44.83; H: 4.70, N: 13.07; found: C: 44.68, H: 4.55, N: 12.90; ^{1}H NMR (*DMSO*-d_6): 2.75–2.80 (m, 4H, H-4, H-5), 3.60 (s, 2H, H-7), 6.65 (s, 2H, NH_2), 6.80 (s, 2H, $CONH_2$); ^{13}C NMR (*DMSO*-d_6): 24.34 (t, C-4), 25.21 (t, C-5), 27.60 (s, C-7), 108.73 (s, C-3), 112.12 (s, C-7a), 130.19 (s, C-3a), 157.63 (s, C-2), 167.52 (s, $CONH_2$).

2-(((2-Propenyl)-aminothioxomethyl)-amino)-4,7-dihydro-5H-thieno[2,3-c]thiopyran-3-carboxamide (**11**)

To a solution of **10** (1.07 g, 0.0049 mol) in acetonitrile/ethanol (1:4, 60 ml) allylisothiocyanate (0.56 g, 0.0056 mol) was added; the mixture was refluxed for 7 hours. After cooling, the yellow precipitated solid was collected by filtration and recrystallized from a mixture of ethanol and *THF* (1:1) to give 0.9 g (61.2% yield) of **11**. M.p.: 192–193 °C; $C_{12}H_{14}N_3OS_3$ (312.44); calc.: C: 46.12, H: 13.44, N: 4.51; found: C: 45.87, H: 4.60, N: 13.34; ^{1}H NMR (*DMSO*-d_6): 2.80–2.95 (m, 4H, H-4, H-5), 3.80 (s, 2H, H-7), 4.10 (bs, 2H, CH_2), 5.09 (m, 1H, =CH), 5.17 (m, 1H, =CH), 5.86 (m, 1H, =CH), 7.40–7.50 (bs, 1H, NH), 9.10 (s, 1H, NH); IR (KBr): 1500, 1580, 1590, 1660, 1680, 2990, 3200, 3400, 3500 cm^{-1}.

3-(2-Propenyl)-2-thioxo-1,5,6,8-tetrahydro-2H-thiopyrano[4',3':4,5]thieno[2,3-d]-pyrimidine-4(3H)one (**12**)

Method A (from **11***):*

A mixture of **11** (0.3 g, 0.0009 mol) in ethanol (10 mol) and concentrated hydrochloric acid (6 ml) was refluxed for 30 min. After cooling to room temperature, the solid was collected by filtration and combined with the solid that was collected from the filtrate by neutralizing it with sodium bicarbonate to give 0.22 g (88% yield) of **12**. An analytical sample was recrystallized from ethanol to afford colorless crystals. M.p.: 208–210 °C; $C_{12}H_{11}N_2OS_3$ (295.42); calc.: C: 48.78, H: 3.75, N: 9.48; found: C: 48.72, H: 3.91, N: 9.36; ^{1}H NMR (*DMSO*-d_6): 2.80 (t, 2H, H-5), 3.00 (t, 2H, H-6), 3.80 (s, 2H, H-8), 4.90 (q, 2H, CH_2), 5.11 (m, 1H, =CH), 5.16 (m, 1H, =CH) 5.90 (m, 1H, =CH), 13.60 (s, 1H, NH).

Method B (from **2***):*

A mixture of **2** (0.49 g, 0.002 mol), allylisothiocyanate (0.4 g, 0.004 mol), and morpholine (0.4 ml) in ethanol (10 ml) was refluxed for 18 hours. After cooling to room temperature, the solid product was collected by filtration and then recrystallized from ethanol to give 0.37 g (62.7% yield) of **12** as colorless crystals. M.p.: 208–209 °C; **2** was spectroscopically equivalent with the material prepared according to method A; a mixed melting point of the two materials was undepressed.

2-Methyl-2,3,6,9-tetrahydro-5H,7H-thiazolo[3,2-a]thiopyrano[4',3':4,5]-thieno[2,3-d]pyrimidin-5-one (**13**)

Method A:

A mixture of **12** (0.4 g, 0.0013 mol) acetic acid (1 ml) and concentrated hydrochloric acid (2 ml) was refluxed for 15 min. After cooling to room temperature, the solid formed by neutralizing the mixture with 10% sodium hydroxide solution was collected by filtration and washed with water (20 ml), affording 0.35 g of crude product which was recrystallized from 15% aqueous ethanol to give 0.28 g (70% yield) of **13**. M.p.: 135–137 °C; $C_{12}H_{11}N_2OS_3$ (295.42); calc.: C: 48.78, H: 3.75, N: 9.48; found: C:

48.59, H: 3.55, N: 9.56; ^{1}H NMR (*DMSO*-d_6): 1.56 (d, 3H, CH_3), 2.85 (t, 2H, H-6), 3.10 (t, 2H, H-7), 3.90 (s, 2H, H-9), 4.02 (m, 1H, H-2), 4.15 (d, 2H, H-3).

Method B (from **4***):*

1,2-Dibromopropane (1.01 g, 0.005 mol) in *DMF* (10 ml) was added to a stirred solution containing **4** (1.29 g, 0.005 mol), water (10 ml), and sodium hydroxide (0.2 g). The mixture was heated at 90 °C for one hour and then stirred at room temperature for 1 additional hour. The reaction mixture was poured into cold water; the precipitated product was collected by filtration and recrystallized from 15% aqueous ethanol to give 0.8 g (54% yield) of **13** as faint yellow crystals. M.p. 134–136 °C; The compound is identical to that obtained according to method A.

Acknowledgments

The author would like to express his gratitude to Prof. Dr. *F. Sauter*, Institute of Organic Chemistry, Technical University Vienna, for the chance to work in this field as well as for his continuous encouragement, to Dr. *J. Fröhlich* (same institute) for his constant help and advices, and to the ÖAD (*Austrian Academic Exchange Service*) for a scholarship.

References

[1] Sauter F, Fröhlich J, Ahmed EK (1995) Monatsh Chem **126**: 945–952
[2] Sauter F, Fröhlich J, Ahmed EK (1995) Heterocycles (submitted)
[3] Noravyan AS, Oganisyan ASh, Basentsyan KE, Vartanvan SA (1983) Arm Khim Zh **36(2)**: 108
[4] Goerdler J, Neuffer J (1971) Chem Ber **104**: 1606
[5] Mohareb RM, Fahmy SM (1986) Z Naturforsch **41b**: 105
[6] Barkenbus C, Midkiff VC, Newman RM (1951) J Org Chem **16**: 232

Received March 15, 1995. Accepted March 20, 1995