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Received December 24, 1990

The reduction of 1-[3-(thienyl-2-carbonitrile)]pyrrole, formed by condensation of 3-aminothiophene-2-carbonitrile with 2,5-dimethoxytetrahydrofuran, gave 1-[3-(thienyl-2-aminomethyl)]pyrrole. This compound was found to be a convenient intermediate for the preparation of 4-aryl-5,6-dihydro-4*H*-pyrrolo[1,2-*a*]thieno-[2,3-*f*][1,4]diazepines which was accomplished by two different synthetic routes.

J. Heterocyclic Chem., **28**, 945 (1991).

In the last few years we have continued to pursue the goal of developing novel therapeutic agents that might be useful in the treatment of psychiatric disorders. Several reports from this laboratory have described a number of nitrogen heterocyclic compounds which exhibited important pharmacological activities especially in the anxiolytic and antipsychotic fields [3-7]. Some of these compounds are thieno-1,4-diazepines which were prepared as thiophene isosteres of the known tranquilizers diazepam and chlordiazepoxide and one of them (QM-6008, bentazepam) has found clinical application.

Our interest in this type of molecular modification and the fact that certain pyrrolobenzodiazepines possess useful CNS activities [8,9] led us to prepare new compounds with a pyrrole ring fused at positions 1 and 2 of the 1,4-thienodiazepine moiety. Although several representatives of the pyrrolo[1,2-*a*]thieno[3,2-*f*][1,4]diazepine ring system are known [10,11] no report, however, seems to be published concerning their thieno[2,3-*f*] and thieno-[3,4-*f*] structural isomers.

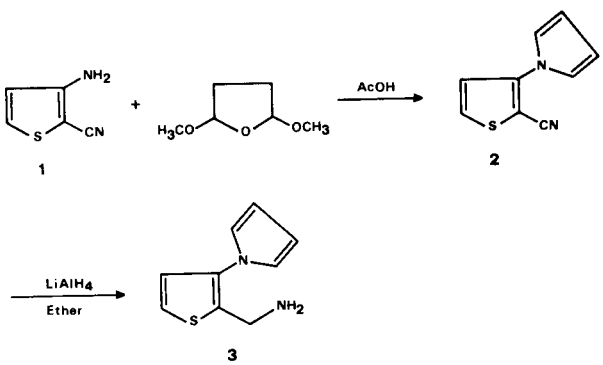
This paper deals with the synthesis of a series of 4-aryl-5,6-dihydro-4*H*-pyrrolo[1,2-*a*]thieno[2,3-*f*][1,4]diazepines **6** that we wish to evaluate as potentially anxiolytic and muscle relaxant agents.

The requisite starting material, 3-aminothiophene-2-carbonitrile (**1**) (Scheme 1), was prepared by the condensation of acetylmercaptoacetonitrile with α-chloroacrylonitrile under the alkaline conditions of the Fiesselmann reaction [12]. Despite the low yields obtained with this method, it compares favourably with other procedures employed in the synthesis of **1**, namely the use in this reaction of propionitrile instead of α-chloroacrylonitrile [13] or the reduction of 3-azidothiophene-2-carbonitrile, formed in three steps from 3-bromo-2-formylthiophene [14].

Aminonitrile **1** was transformed into the so far unknown 1-[3-(2-aminomethyl)thienyl]pyrrole (**3**) using essentially the published procedure for the preparation of its 1-[2-(3-aminomethylthienyl]isomer [11]. Thus, 3-aminothiophene-2-carbonitrile **1** was condensed with 2,5-dimethoxytetrahydrofuran in the presence of glacial acetic acid, according the method described by Clauson-Kaas and Tyle [15], resulting in 1-[3-(thienyl-2-carbonitrile)]pyrrole (**2**), which was subsequently reduced to the desired aminomethyl compound **3** with lithium aluminium hydride in dry ether. The successive transformations of the NH_2 and CN groups of the compounds mediated in both reactions permitted their easy control by infrared spectrometry.

As depicted in Scheme 2, reaction of aminomethyl derivative **3** with the appropriately substituted benzaldehydes afforded the intermediate Schiff's bases **4**. Ring closure to the target compounds **6** was accomplished by treatment of **4** with gaseous hydrogen chloride in ethanol; in this way the expected hydrochloride salts **5** were isolated. They were converted into the corresponding pyrrolo-thieno-diazepines **6** by treatment with aqueous sodium hydroxide.

Scheme 1



Scheme 2

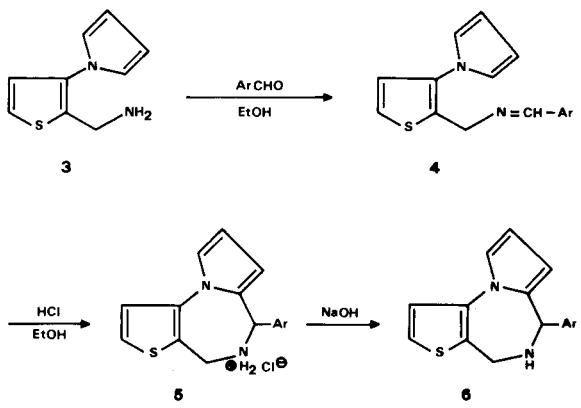


Table 1
Physical, IR and Analytical Data of Compounds **5** and **6**

Compound	Ar	Yield (%)	Mp (°C) Solvent	ν (cm-1)	Formula	Analysis Calcd./Found (%) C	H	N	S
5a	C_6H_5	48	216 dec Ethanol-Water (5:1)	1560	$C_{16}H_{15}ClN_2S$	63.47 63.19	4.95 5.20	9.25 9.00	10.57 10.25
6a			72-74 Ethanol	3300	$C_{16}H_{14}N_2S$	72.18 72.54	5.26 5.44	10.52 10.60	12.03 11.60
5b	C_6H_4-Cl (*o*)	62	212 dec Propanol	1560	$C_{16}H_{14}Cl_2N_2S$	56.97 57.00	4.15 4.33	8.30 8.45	9.49 9.30
6b			111-113 Ethanol	3320	$C_{16}H_{13}ClN_2S$	63.89 64.07	4.32 4.43	9.31 9.60	10.64 10.35
5c	C_6H_4-Cl (*m*)	56	205 dec Ethanol	1560	$C_{16}H_{14}Cl_2N_2S$	56.97 56.54	4.15 4.33	8.30 8.01	9.49 8.99
6c			94-96 Ethanol	3300	$C_{16}H_{13}ClN_2S$	63.89 64.07	4.32 4.38	9.31 9.50	10.64 11.00
5d	C_6H_4-Cl (*p*)	53	212 dec Ethanol	1560	$C_{16}H_{14}Cl_2N_2S$	56.97 57.14	4.15 4.30	8.30 8.53	9.49 9.30
6d			113-115 Ethanol	3300	$C_{16}H_{13}ClN_2S$	63.89 64.00	4.32 4.56	9.31 9.24	10.64 10.61
5e	C_6H_4-NO_2 (*p*)		211 dec Butanol	1600	$C_{16}H_{14}ClN_3O_2S$	55.25 55.39	4.02 4.22	12.08 12.06	9.20 9.40
6e			136-138 Ethanol	3320	$C_{16}H_{13}N_3O_2S$	61.73 62.06	4.18 4.53	13.50 13.26	10.28 10.17
5f	C_6H_4-OCH_3 (*m*)	65	209 dec Ethanol	1600	$C_{17}H_{17}ClN_2OS$	61.35 61.39	5.11 5.08	8.42 8.45	9.62 9.40
6f			[a]	3300	$C_{17}H_{16}N_2OS$	68.91 68.74	5.40 5.42	9.45 9.53	10.81 10.70
5g	C_6H_4-OCH_3 (*p*)	63	215 dec Ethanol	1610	$C_{17}H_{17}ClN_2OS$	61.35 61.34	5.11 5.09	8.42 8.43	9.62 10.00
6g			82-84 Ethanol	3300	$C_{17}H_{16}N_2OS$	68.91 69.31	5.40 5.61	9.45 9.75	10.81 10.50
5h	C_6H_3-$(OCH_3)_2$ (3,4)	52	220-222 Ethanol	1570	$C_{18}H_{19}ClN_2O_2S$	59.58 59.73	5.24 5.23	7.72 7.95	8.82 8.65
6h			120-122 Ethanol	3300	$C_{18}H_{18}N_2O_2S$	66.25 66.58	5.52 5.88	8.58 8.51	9.81 9.70
5i	C_6H_3-OCH_2O (3,4)	62	225-227 Ethanol-Water (3:1)	1600	$C_{17}H_{15}ClN_2O_2S$	58.87 58.59	4.31 4.17	8.08 7.96	9.23 9.38
6i			87-89 Ethanol	3300	$C_{17}H_{14}N_2O_2S$	65.80 66.15	4.51 4.73	9.03 9.23	10.32 10.60

[a] Oil ^{27} n = 1.6290.

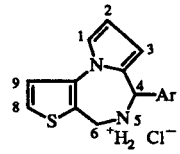
In general, the above described process was carried out in a two-step synthetic sequence, without isolation of the intermediate benzylidene derivatives **4**. Some of these compounds, however, were isolated and characterized before the cyclization reaction. It was also verified that these reactions may be carried out in an one-pot procedure, but in this case the overall yields of the final compounds are considerably lower.

Table 1 shows the physical and analytical properties as well as the ir spectroscopic characteristics of diazepines **6** and their respective hydrochloride salts **5**. Compounds **6** exhibited in their infrared spectra a sharp band at 3320-3300 cm^{-1} due to the NH stretching vibration. This signal appeared as a broad band at 3200-2000 cm^{-1} in the ir spectra of salts **5**. The ^{1}H-nmr spectra in deuteriochloroform solution of free bases **6** (Table 3) showed the signals corresponding to the NH and CH_2 protons as singlets at δ 2.02-2.13 and δ 4.23-4.31 respectively, while the spectra of compounds **5** in DMSO-d_6 solution at 60° exhibited the CH_2 protons signals as two doublets at δ 4.15 and 4.50 (J_{AB} = 15.0 Hz), probably due to the nonplanar rigid structure of the tricyclic system.

Finally, a different route for the synthesis of the tricyclic compounds **6** was developed (Scheme 3). It involved acylation of aminomethyl-thienyl-pyrrole **3** under standard conditions, followed by cyclization of the acyl derivatives **7** with phosphorous oxychloride or a mixture of phospho-

Table 2

^{1}H-NMR Data of Compounds **5a-i**

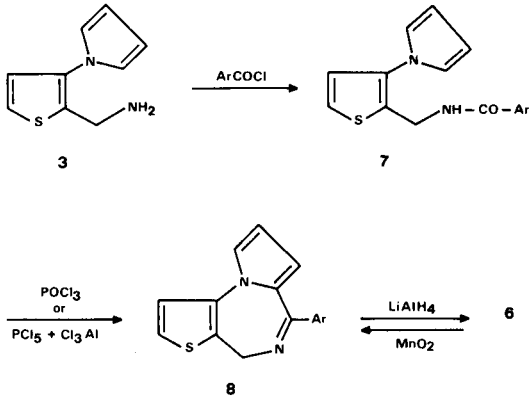


Compound	δH1 (dd) [a]	δH2 (dd)	δH3 (ddd)	δH4 (s)	δCH_2 (AB)	δH8 (d)	δH9 (d)	δ$^+NH_2$ (bs)	δAr
5a	7.35	6.21	5.79	5.37	4.16, 4.50	7.76	7.42	10.74	7.45-7.52 (m, H2', 4' and 6'), 7.68-7.74 (m, H3' and 5')
5b	7.38	6.21	5.61	5.54	4.19, 4.60	7.82	7.47	10.86	7.50-7.59 (m, H4', 5' and 6'), 8.26-8.31 (m, H3')
5c	7.36	6.22	5.78	5.45	4.17, 4.51	7.76	7.41	10.68	7.47-7.50 (m, H5' and 6'), 7.66-7.72 (m, H4'), 7.84 (s, H2')
5d	7.35	6.20	5.80	5.40	4.14, 4.48	7.75	7.40	10.78	7.49 (d, $J_{H2',H3'} = J_{H6',H5'} = 8.5$ Hz, H2' and 6'), 7.76 (d, H3' and 5')
5e	7.40	6.21	5.73	5.62	4.17, 4.56	7.78	7.43	10.94	8.02 (d, $J_{H2',H3'} = J_{H6',H5'} = 8.8$ Hz, H2' and 6'), 8.36 (d, H3' and 5')
5f	7.35-7.44 (*m*) [b]	6.22	5.84	5.35	4.15, 4.49	7.78	7.42	10.66	3.80 (s, -OCH_3), 7.00 (dd, $J_{H4',H5'} = 8.1$ Hz, $J_{H4',H6'} = 2.5$ Hz, H4'), 7.23 (d, $J_{H6',H5} = 7.8$ Hz, H6') 7.36 (dd, H5'), 7.35-7.44 (m, H2')
5g	7.34	6.21	5.80	5.29	4.12, 4.47	7.76	7.41	10.64	3.80 (s, -OCH_3), 7.00 (d, $J_{H2',H3'} = J_{H6',H5'} = 8.7$ Hz, H2' and 6'), 7.64 (d, H3' and 5')
5h	7.34	6.22	5.88	5.27	4.11, 4.46	7.76	7.42	10.65	3.79 (s, -OCH_3), 3.80 (s, -OCH_3), 7.00 (d, $J_{H5',H6'} = 8.4$ Hz, H5'), 7.18 (dd, $J_{H6',H2'} = 2.0$ Hz, H6'), 7.50 (d, H2')
5i	7.34	6.21	5.86	5.28	4.12, 4.47	7.76	7.41	10.65	6.06 (s, -OCH_2O-), 6.95 (d, $J_{H5',H6'} = 8.0$ Hz, H5'), 7.18 (dd, $J_{H6',H2'} = 1.8$ Hz, H6'), 7.38 (d, H2')

Coupling constants: $J_{H1,H2} = 2.9$ Hz, $J_{H1,H3} = 1.5$ Hz, $J_{H2,H3} = 3.6$ Hz, $J_{H3,H4} = 0.9$ Hz, $J_{AB} = 15.0$ Hz, $J_{H8,H9} = 5.4$ Hz. [a] Multiplicity. [b] Overlaped by the protons signal of Ar.

rous pentachloride and aluminum(III) chloride. The new 6*H*-pyrrolo[1,2-*a*]thieno[2,3-*f*][1,4]diazepines **8** formed were subsequently reduced to **6** with lithium aluminium hydride in tetrahydrofuran. This alternative route, exemplified by the synthesis of phenyl, *p*-chlorophenyl and *p*-nitrophenyl derivatives **6a**, **6d** and **6e** respectively, resulted to be less convenient, mainly due to the poor yields obtained in the intramolecular cyclization reaction of the 1-[3-(2-benzamidomethyl)thienyl]pyrroles **7**. On the other hand, compounds **6** could be converted to the diazepines **8** by oxidation with manganese(II) oxide in chloroform.

Scheme 3



EXPERIMENTAL

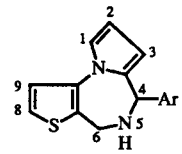
All melting points (uncorrected) were determined using a Gallenkamp capillary apparatus. The ir spectra were recorded on a Perkin Elmer 257 instrument. The ^{1}H-nmr spectra were measured with a Bruker AM-200 and a Varian XL-300 spectrometers using TMS as internal standard. The purity of compounds was verified by thin-layer chromatography (tlc) which was run on silica gel GF_{254} (Merck) or aluminiumoxid 60 F_{254} (Merck) with cyclohexane-ethyl acetate mixtures (2:1 and 1:1, v/v respectively) as eluents.

1-[3-(Thienyl-2-carbonitrile)]pyrrole (**2**).

A mixture of 3-aminothiophene-2-carbonitrile [11] (124 g, 1.0 mole), 2,5-dimethoxytetrahydrofuran (132 g, 1.0 mole) and glacial acetic acid (1000 ml) was heated under reflux for 30 minutes. The acetic acid and ethyl acetate formed was evaporated off and the

Table 3

^{1}H-MNR Data of Compounds **6a-i**



Compound	δ H1 (dd) [a]	δ H2 (dd)	δ H3 (ddd)	δ H4 (s)	δ CH_2 (AB)	δ H8 (d)	δ H9 (d)	δ NH_2 (bs)	δ Ar
6a	7.05	6.11	5.47	5.04	4.28	7.23	7.17	2.13	7.30-7.39 (m, H2', 4' and 6'), 7.41-7.44 (m, H3' and 5')
6b	7.06	6.08	5.33	5.40	4.31	7.24	7.19	2.10	7.27-7.37 (m, H4', 5' and 6'), 7.63 (dd, $J_{H3',H4'}$ = 7.5 Hz, $J_{H3',H5'}$ = 1.7 Hz, H3')
6c	7.04	6.12	5.48	5.02	4.26	7.23	7.13	2.02	7.25-7.27 (m, H4', 5' and 6'), 7.46 (s, H2')
6d	7.03	6.10	5.45	5.01	4.23	7.22	7.12	2.09	7.30 (d, $J_{H2',H3'} = J_{H6',H5'}$ = 8.5 Hz, H2' and 6'), 7.35 (d, H3' and 5')
6e	7.04	6.13	5.45	5.17	4.25	7.23	7.11	2.09	7.60 (d, $J_{H2',H3'} = J_{H6',H5'}$ = 8.8 Hz, H2' and 6'), 8.19 (d, 3' and 5')
6f	7.03	6.10	5.51	5.02	4.26	7.21	7.13	2.11	3.79 (s, $-OCH_3$), 6.83 (ddd, $J_{H4',H5'}$ = 8.2 Hz, $J_{H4',H6'}$ = 2.5 Hz, $J_{H4',H2'}$ = 1.1 Hz, H4'), 6.96-7.0 (m, H2' and 6'), 7.25 (dd, $J_{H5',H6'}$ = 8.8 Hz, H5')
6g	7.03	6.10	5.25	4.99	4.25	7.21	7.13	2.02	3.8 (s, $-OCH_3$), 6.88 (d, $J_{H2',H3'} = J_{H6',H5'}$ = 8.8 Hz, H2' and 6'), 7.33 (d, H3' and 5')
6h	7.00-7.04 (*m*) [b]	6.12	5.54	5.00	4.24	7.21	7.13	2.02	3.86 (s, $-OCH_3$), 3.88 (s, $-OCH_3$), 6.83 (d, $J_{H5',H6'}$ = 8.2 Hz, H5'), 6.93 (dd, $J_{H6',H2'}$ = 2.0, H6'), 7.00-7.04 (m, H2')
6i	7.03	6.12	5.56	4.97	4.24	7.21	7.13	2.02	5.95 and 5.96 (AB, J_{AB} = 1.4 Hz, $-OCH_2O-$), 6.77 (d, $J_{H5',H6'}$ = 8.0 Hz, H5'), 6.86 (dd, $J_{H6',H2'}$ = 1.7 Hz, H6'), 6.95 (d, H2')

Coupling constants: $J_{H1,H2}$ = 2.9 Hz, $J_{H1,H3}$ = 1.7 Hz, $J_{H2,H3}$ = 3.5 Hz, $J_{H3,H4}$ = 0.9 Hz, $J_{H8,H9}$ = 5.4 Hz. [a] Multiplicity. [b] Overlaped by the protons signal of Ar.

residue was then distilled at 0.2 mm Hg; a fraction (154.8 g, 89%) of bp 105-110° crystallized on cooling to give 1-[3-(thienyl-2-carbonitrile)]pyrrole mp 48-50° (ethanol); ir (potassium bromide): 2220 cm^{-1} (CN); ^{1}H-nmr (deuteriochloroform): δ 6.36 (t, 2H, J = 2.2 Hz, pyrrole β-protons), 7.12 (d, 1H, J = 5.4 Hz, thiophene H-4), 7.24 (t, 2H, pyrrole α-protons), 7.55 (d, 1H, thiophene H-5); ms: m/z 174 (M^+, 100%).

Anal. Calcd. for $C_9H_6N_2S$: C, 62.06; H, 3.44; N, 16.09; S, 18.39. Found: C, 62.19; H, 3.58; N, 16.22; S, 18.21.

1-[3-(2-Aminomethyl)thienyl]pyrrole (**3**).

To a stirred suspension of lithium aluminum hydride (22.8 g, 0.6 mole) in dry ether (750 ml) was slowly added a solution of 1-[3-(thienyl-2-carbonitrile)]pyrrole (87.0 g, 0.5 mole) in dry ether (750 ml). The mixture was stirred and heated under reflux for 8 hours, then cooled and carefully decomposed with water (500 ml). After filtration, the organic layer was separated, washed with water, dried (magnesium sulfate) and evaporated. Distillation of the oily residue at 0.2 mm Hg gave the aminomethyl derivative **3** of bp 100-105° (74.8 g, 84%); ir (film): 3350, 3300, 1560 cm^{-1} (NH_2); ^{1}H-nmr (deuteriochloroform): δ 1.50 (broad s, 2H, exchangeable with deuterium oxide, NH_2), 3.98 (s, 2H, CH_2), 6.29 (t, 2H, J = 2.2 Hz, pyrrole β-protons), 6.83 (t, 2H, pyrrole α-protons), 6.96 (d, 1H, J = 5.3 Hz, thiophene H-4), 7.17 (d, 1H, thiophene H-5); ms: m/z 178 (M^+, 100%).

The picrate salt prepared in ethanol, had mp >230° dec (ethanol).

Anal. Calcd. for $C_{15}H_{13}N_5O_7S$: C, 44.22; H, 3.19; N, 17.19; S, 7.86. Found: C, 44.43; H, 3.23; N, 17.47; S, 7.78.

1-[3-(2-Benzylideneaminomethyl)thienyl]pyrroles **4**.

General Method.

A mixture of 1-[3-(2-aminomethyl)thienyl]pyrrole **3** (0.02 mole), the appropriate benzaldehyde (0.02 mole) and ethanol (50 ml) was heated under reflux for 15-30 minutes. The solvent was evaporated *in vacuo* to give the corresponding Schiff's bases **4** as oils which, in general, could not be purified by distillation or crystallisation from the common solvents. For this reason they were used as such in the next reaction. In some cases, however, compounds **4** precipitated on cooling the reaction mixture. In these cases they were isolated by filtration and identified as described in the following examples:

1-[3-(2-*p*-Nitrobenzylideneaminomethyl)thienyl]pyrrole.

This compound was obtained in 84% yield from *p*-nitrobenzaldehyde as yellow crystals of mp 87-88° (ethanol); ir (potassium bromide): 1640 cm^{-1} (C=N); ^{1}H-nmr (deuteriochloroform): δ 4.89 (s, 2H, CH_2), 6.26 (t, 2H, J = 2.0 Hz, pyrrole β-protons), 6.85 (t, 2H, pyrrole α-protons), 7.00 (d, 1H, J = 5.4 Hz, thiophene H-4), 7.23 (d, 1H, thiophene H-5), 7.85 (d, 2H, J = 9 Hz, benzene H-2 and H-6), 8.13 (d, 2H, benzene H-3 and H-5), 8.19 (s, 1H, CH); ms: m/z 311 (M^+).

Anal. Calcd. for $C_{16}H_{13}N_3O_2S$: C, 61.73; H, 4.18; N, 13.50; S, 10.28. Found: C, 61.63; H, 4.19; N, 13.40; S, 10.02.

1-[3-(2-(3,4-Dimethoxy)benzylideneaminomethyl)thienyl]pyrrole.

This compound was obtained in 68% yield from 3,4-dimethoxybenzaldehyde, mp 88-90° (ethanol); ir (potassium bromide): 1630 cm^{-1} (C=N); ^{1}H-nmr (deuteriochloroform): δ 3.92 (s, 3H, OCH_3), 3.94 (s, 3H, OCH_3), 4.85 (s, 2H, CH_2), 6.33 (t, 2H, J = 2.0 Hz, pyrrole β-protons), 6.80-6.90 (m, 3H, benzene H-2 and pyrrole α-protons), 7.03 (d, 1H, J = 5.4 Hz, thiophene H-4), 7.11-7.16 (m, 1H, benzene), 7.23 (d, 1H, thiophene H-5), 7.44-7.48 (m, 1H, benzene), 8.16 (s, 1H, CH).

Anal. Calcd. for $C_{18}H_{16}N_2O_2S$: C, 66.25; H, 5.52; N, 8.58; S, 9.81. Found: C, 66.46; H, 5.51; N, 8.70; S, 9.77.

1-[3-(2-(3,4-Methylendioxy)benzylidenaminomethyl)thienyl]pyrrole.

This compound was obtained in 77% yield from 3,4-methylendioxybenzaldehyde as a yellow solid of mp 53-55° (ethanol); ir (potassium bromide): 1630 cm^{-1} (C=N); ^{1}H-nmr (deuteriochloroform): δ 4.79 (s, 2H, CH_2), 5.95 (s, 2H, OCH_2O), 6.24 (t, 2H, J = 2.1 Hz, pyrrole β-protons), 6.75 (m, 1H, benzene H-2), 6.85 (t, 1H, pyrrole α-protons), 7.00 (d, 1H, J = 5.4 Hz, thiophene H-4), 7.07-7.10 (m, 1H, benzene), 7.13 (d, 1H, thiophene H-5), 7.35-7.39 (m, 1H, benzene), 8.09 (s, 1H, CH).

Anal. Calcd. for $C_{17}H_{14}N_2O_2S$: C, 65.80; H, 4.51; N, 9.03; S, 10.32. Found: C, 66.00; H, 4.41; N, 9.17; S, 10.39.

4-Aryl-5,6-dihydro-4*H*-pyrrolo[1,2-*a*]thieno[2,3-*f*][1,4]diazepines **6**.

Method A.

The crude benzylidene derivative **4** obtained above was dissolved in absolute ethanol saturated with dry hydrogen chloride (50 ml) and the solution heated under reflux for 45 minutes. After cooling, the precipitated hydrochloride salts **5** were filtered off, washed with dry ether and recrystallized from the appropriate solvent. The free bases **6** were obtained by treatment of **5** with dilute sodium hydroxide and extraction with ether or chloroform. Table 1 lists the yields, the physical and analytical data as well as the characteristic ir bands of all the compounds **5** and **6** synthesized. Their main ^{1}H-nmr spectroscopic features are summarized in Tables 2 and 3.

Method B.

To a stirred mixture of lithium aluminium hydride (0.06 mole) and tetrahydrofuran (50 ml) was slowly added the obtained 6*H*-pyrrolo[1,2-*a*]thieno[2,3-*f*][1,4]diazepines **8a**, **8d** or **8e** (0.055 mole). The mixture was heated under reflux for 10 hours, then cooled and heated with water (500 ml). The precipitated solid was filtered, washed with water and dried to give the diazepines **6a**, **6d** and **6e** in 87, 78 and 79% yield respectively.

1-[3-(2-Benzamidomethyl)thienyl]pyrrole (**7a**).

A solution of 1-[3-(2-aminomethyl)thienyl]pyrrole (**3**) (3.5 g, 0.02 mole) and triethylamine (4.16 ml, 3.02 g, 0.03 mole) in methylene chloride (20 ml) was cooled to 0° and then treated dropwise with benzoyl chloride (2.3 ml, 2.8 g, 0.02 mole). The mixture was stirred at room temperature for 1 hour and the precipitate formed was filtered, washed with methylene chloride and dried to give 4.6 g (82%) of **7a** as white crystals of mp 114-115° (ethanol); ir (potassium bromide): 3350 cm^{-1} (NH), 1630 cm^{-1} (CO); ^{1}H-nmr (DMSO-d_6): δ 4.62 (d, 2H, J = 5.9 Hz, CH_2), 6.26 (t, 2H, J = 2.0 Hz, pyrrole β-protons), 7.06-7.23 (m, 3H, pyrrole α-protons and thiophene H-4), 7.46-7.62 (m, 4H, thiophene H-5 and benzene), 7.85-8.00 (m, 2H, benzene), 9.23 (broad s, 1H, exchangeable with deuterium oxide, NH).

Anal. Calcd. for $C_{16}H_{14}N_2OS$: C, 68.08; H, 4.96; N, 9.92. Found: C, 68.06; H, 5.11; N, 10.01.

1-[3-(2-*p*-Chlorobenzamidomethyl)thienyl]pyrrole (**7d**).

This compound was obtained by the above procedure in 89% yield from **3** and *p*-chlorobenzoyl chloride as a yellow solid of mp 173-175° (ethanol); ir (potassium bromide): 3300 cm^{-1} (NH), 1620 cm^{-1} (CO); ^{1}H-nmr (DMSO-d_6): δ 4.59 (d, 2H, J = 5.9 Hz, CH_2), 6.26 (t, 2H, J = 2.0 Hz, pyrrole β-protons), 7.09 (d, 1H, J = 5.4 Hz, thiophene H-4), 7.19 (t, 2H, pyrrole α-protons), 7.49 (d, 1H, thiophene H-5), 7.56 (d, 2H, J = 9.0 Hz, benzene), 7.92 (d, 2H, benzene), 9.26 (broad s, 1H, exchangeable with deuterium oxide, NH).

Anal. Calcd. for $C_{16}H_{13}ClN_2OS$: C, 60.66; H, 4.10; N, 8.84. Found: C, 60.46; H, 4.20; N, 9.13.

1-[3-(2-*p*-Nitrobenzamidomethyl)thienyl]pyrrole (**7e**).

This compound was obtained by the above procedure in 74% yield from **3** and *p*-nitrobenzoyl chloride as yellow crystalline needles of mp 154-156° (ethanol); ir (potassium bromide): 3280 cm^{-1} (NH), 1630 cm^{-1} (CO); ^{1}H-nmr (DMSO-d_6): δ 4629 (d, 2H, J = 5.9 Hz, CH_2), 6.26 (t, 2H, J = 2.0 Hz, pyrrole β-protons), 7.09 (d, 1H, J = 5.4 Hz, thiophene H-4), 7.16 (t, 2H, pyrrole α-protons), 7.52 (d, 1H, thiophene H-5), 8.13 (d, 2H, J = 9.0 Hz, benzene), 8.36 (d, 2H, benzene), 9.56 (broad s, 1H, exchangeable with deuterium oxide, NH).

4-*p*-Chlorophenyl-6*H*-pyrrolo[1,2-*a*]thieno[2,3-*f*][1,4]diazepine (**8d**).

A mixture of 1-[3-(2-*p*-chlorobenzamidomethyl)thienyl]pyrrole (3.1 g, 0.01 mole) and phosphorus oxychloride (14.7 g, 0.1 mole) was refluxed for 2 hours. Excess of phosphorus oxychloride was then removed by distillation and the residue was cautiously treated with ice-water and basified with 20% sodium hydroxide solution. The product was extracted with chloroform and the extracts were washed with water, dried (magnesium sulfate) and evaporated. The residue was chromatographed on a alumina using a mixture of ethyl acetate-hexane 1:6 to give 772 mg (26%) of pure **8d** as white crystals of mp 114-115° (ethanol); ir (potassium bromide): 1650, 1590 cm^{-1} (C=N); ^{1}H-nmr (DMSO-d_6): δ 4.70 (s, 2H, CH_2), 6.36 (dd, 1H, J = 3.8 Hz, J = 2.7 Hz, H-2), 6.40 (dd, 1H, J = 1.6 Hz, H-3), 7.11 (d, 1H, J = 5.4 Hz, H-9), 7.21 (d, 1H, H-8), 7.26 (dd, 1H, H-1), 7.32 (d, 2H, J = 8.7 Hz, benzene), 7.56 (d, 2H, benzene); ms: m/z 298 (M^+).

Anal. Calcd for $C_{16}H_{11}ClN_2S$: C, 64.42; H, 3.69; N, 9.38.Found: C, 64.50; H, 3.78; N, 9.25.

4-*p*-Nitrophenyl-6*H*-pyrrolo[1,2-*a*]thieno[2,3-*f*][1,4]diazepine (**8e**).

This compound was prepared by the method described above from the *p*-nitrobenzamide derivative **7e** and phosphorus oxychloride, yellow crystals (22%) of mp 169-171° (ethanol); ir (potassium bromide): 1640, 1600 cm^{-1} (C=N); ^{1}H-nmr (DMSO-d_6): δ 4.75 (s, 2H, CH_2), 6.36 (dd, 1H, J = 3.6 Hz, J = 2.8 Hz, H-2), 6.43 (dd, 1H, J = 1.6 Hz, H-3), 7.14 (d, 1H, J = 5.4 Hz, H-9), 7.20 (dd, 1H, H-1), 7.30 (d, 1H, H-8), 7.80 (d, 2H, J = 9.0 Hz, benzene), 8.00 (d, 2H, benzene).

Anal. Calcd. for $C_{16}H_{11}N_3O_2S$: C, 62.13; H, 3.55; N, 13.59; S, 10.35. Found: C, 62.00; H, 3.40; N, 13.83; S, 10.47.

4-Phenyl-6*H*-pyrrolo[1,2-*a*]thieno[2,3-*f*][1,4]diazepine (**8a**).

This compound was prepared in similar way from the benzamide **7a** (2.8 g, 0.01 mole), phosphorus pentachloride (2.02 g, 0.012 mole) and aluminium(III) chloride (1.32 g, 0.01 mole), to give 660 mg (25%) of white crystals of mp 120-122° (ethanol); ir (potassium bromide): 1670, 1590 cm^{-1} (C=N); ^{1}H-nmr (DMSO-d_6): δ 4.65 (s, 2H, CH_2), 6.34 (dd, 1H, J = 3.6 Hz, J = 1.6 Hz, H-3), 6.36 (dd, 1H, J = 2.7 Hz, H-2), 7.02 (d, 1H, J = 5.4 Hz, H-9), 7.09 (d, 1H, H-8), 7.17 (dd, 1H, H-1), 7.20-7.33 (m, 3H, benzene), 7.53-7.58 (m, 2H, benzene).

Anal. Calcd. for $C_{16}H_{12}N_2S$: C, 72.72; H, 4.54; N, 10.60; S, 12.12. Found: C, 72.58; H, 4.64; N, 10.60; S, 12.23.

4-*o*-Chlorophenyl-6*H*-pyrrolo[1,2-*a*]thieno[2,3-*f*][1,4]diazepine (**8b**).

Manganese dioxide (2.6 g, 0.03 mole) was added to a solution of compound **6b** (0.9 g, 0.003 mole) in dry benzene (20 ml). The mixture was stirred and refluxed for 24 hours and then filtered. The filtrate was treated with charcoal and evaporated *in vacuo*. The residue was chromatographed on alumina using a mixture of ethyl acetate-hexane 1:4 as eluent to yield 322 mg (36%) of a yellow solid of mp 134-136° (ethanol); ir (potassium bromide): 1640, 1600 cm^{-1} (C=N); ^{1}H-nmr (DMSO-d_6): δ 4.69 (s, 2H, CH_2), 6.28 (dd, 1H, J = 3.6 Hz, J = 2.8 Hz, H-2), 6.33 (dd, 1H, J = 1.6 Hz, H-3), 7.04 (dd, 1H, H-1), 7.30 (d, 1H, J = 5.4 Hz, H-9), 7.31-7.45 (m, 3H, benzene), 7.60 (d, 1H, H-8), 8.14 (dd, 1H, benzene).

Anal. Calcd. for $C_{16}H_{11}ClN_2S$: C, 64.32; H, 3.68; N, 9.38; S, 10.72. Found: C, 64.10; H, 3.90; N, 9.60; S, 10.80.

Acknowledgements.

We are indebted to the Comisión Interministerial de Ciencia y Tecnología for the financial support of this work and our Department of Analysis for all analytical and spectral data.

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