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THIENO[2,3-*d*]PYRIMIDIN-4-ONES

1. CONDENSATION OF 2,3-DIMETHYL- AND 2,3-TRI-, 2,3-TETRA-, AND 2,3-PENTAMETHYLENE-7,8-DIHYDRO-PYRROLO[1,2-*a*]THIENO[2,3-*d*]PYRIMINIDIN-4(6H)-ONES WITH AROMATIC ALDEHYDES AND FURFURAL

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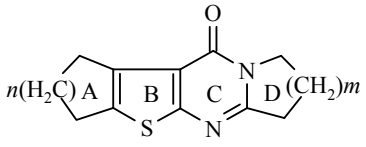
2,3-Dimethyl- and 2,3-tri-, 2,3-tetra-, and 2,3-pentamethylene-substituted 8-arylidene-6,7-dihydro-pyrrolo[1,2-a]thieno[2,3-d]pyrimidin-4-ones were synthesized by the reaction of 2,3-dimethyl- and 2,3-tri-, 2,3-tetra-, and 2,3-pentamethylene-7,8-dihydropyrrolo[1,2-a]thieno[2,3-d]pyrimidin-4(6H)-ones with benzaldehyde, its 4-dimethylamino-, 3,4-dimethoxy-, and 3,4-methylenedioxy derivatives and also furfural in the presence of NaOH.

Keywords: arylidene derivatives, aromatic aldehydes, thieno[2,3-*d*]pyrimidin-4-ones, furfural, condensation.

Among the large number of compounds of the thieno[2,3-*d*]pyrimidin-4-one series annelated at both heterocycles, derivatives of type **I** have been little studied. At the same time, among them are known substances which possess various biological activities (fungicidal, bactericidal, anti-inflammatory, etc.) [3-9], which shows potential for further synthesis and the study of properties of substances with similar structures.

The objective of the present work is the synthesis of new derivatives of type **I**. They are traditionally synthesized from 2-amino-3-ethoxycarbonyl-4,5-disubstituted thiophenes by condensation with lactams [10, 11] or O-alkyl esters of lactams [3], and also from cyclic ketones by the Gewald reaction [12,13]. Oxidation [14, 15] and formylation [16, 17] of such compounds occurs exclusively at the CH_2 group of ring A connected with the heterocyclic system of rings B and C at position 2.



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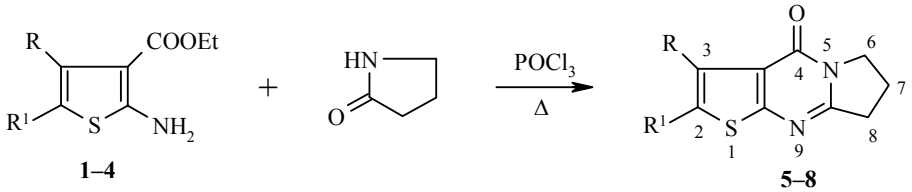
It is also known that tricyclic quinazoline alkaloids – 2,3-tri- and 2,3-tetramethylene-3,4-dihydroquinazolin-4-ones and their substituents and homologs – condense with aromatic and heterocyclic aldehydes at the CH_2 group connected to the quinazolinone nucleus, similar to the 6-CH_2 group of type **I** compounds, and form in this way either arylidene- or arylhydroxymethylderivatives [18, 22]. There are no in the data literature on the interactions of tri(tetra)cyclic 7,8-dihydropyrrolo[1,2-*a*]thieno[2,3-*d*]pyrimidin-4(6H)-ones, thiophene analogs of the alkaloids mentioned.

We have obtained the known 2,3-dimethyl-, 2,3-tri-, 2,3-tetra-, and 2,3-pentamethylene-7,8-dihydropyrrolo[1,2-*a*]thieno[2,3-*d*]pyrimidin-4(6H)-ones **5-8** from 4,5-dimethyl- and 4,5-tri-, 4,5-tetra-, and 4,5-pentamethylene-substituted 2-amino-3-ethoxycarbonylthiophenes **1-4** and γ-butyrolactam in the presence of phosphorus oxychloride, and we have studied the reactions of compounds **5-8** with benzaldehyde (**9a**), 4-dimethylamino- (**9b**), 3,4-dimethoxy- (**9c**), 3,4-methylenebisoxybenzaldehyde (**9d**) and also furfural (**9e**):



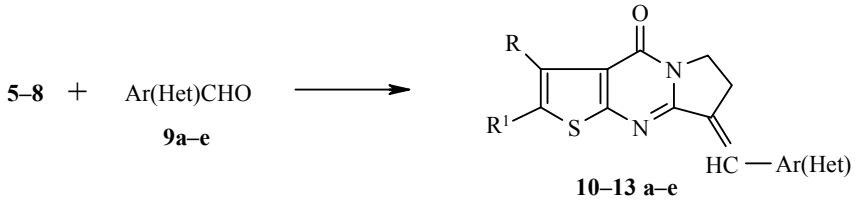
1–4 **5–8**

1, 5 R = R^1 = Me, **2, 6** R + R^1 = $(CH_2)_3$, **3, 7** R + R^1 = $(CH_2)_4$, **4, 8** R + R^1 = $(CH_2)_5$

The synthesis of compounds **5-8** was carried out by a modified methodology [11]. Addition of $POCl_3$ to the reagents on cooling, rather than at room temperature, an increased reaction time and treatment of the reaction mixture with ice water gave products **5-8** in high yields (82-96%).

The structures of the compounds synthesized were confirmed from the ^{1}H NMR spectra cited in the Experimental section, which agree with known data for structurally related compounds [10, 20-22]. The characteristics which are important for further analysis of the direction of the interaction of compounds **5-8** with the aldehydes **9** are the signals of protons H-6 and H-8 each appearing as two-proton triplets in the regions 4.10-4.11 (J = 7.1-7.3) and 3.07-3.10 ppm (J = 7.9-8.1 Hz) respectively.

As a result of the condensation of dihydrothienopyrrolopyrimidin-4-ones **5-8** with aldehydes **9a-e** under optimal conditions (boiling the reagents for 7-8 h in ethanol in the presence of NaOH in the ratio of **5-8**:**9**:NaOH equal to 1:1:0.3) the corresponding 8-arylidenhetarylidene-substituted compounds **10a-e** – **13a-e** were obtained in 61-96% yields. The highest yields were obtained in the case of furfural (89-96%). We have previously reported the synthesis of compounds **10, 11** (see [23, 24]).



10–13 a–e

5, 10a–e R = R^1 = Me; **6, 11a–e** R + R^1 = $(CH_2)_3$; **7, 12a–e** R + R^1 = $(CH_2)_4$;
8, 13a–e R + R^1 = $(CH_2)_5$; **9a–d** – **13a–d** Ar = C_6H_3 R^2-*m*, R^3-*p*, **a** R^2 = R^3 = H, **b** R^2 = H, R^3 = $N(Me)_2$, **c** R^2 = R^3 = OMe, **d** R^2 + R^3 = OCH_2O; **9e–13e** Het = furyl-2

To elucidate the influence of various factors on the interaction of aldehydes **9** with compounds **6-8** (for example, it was expected that it would also occur at position 2-CH_2 of the latter), we have carried out condensation of the aldehydes **9b-e** with compound **6** with various ratios of the reagents (**9b-e**:**6** = 2:1, 3:1, 4:1) under different conditions: in ethanol with NaOH at room temperature (2-24 h duration), and at 80°C (2-8 h), and in boiling glacial

acetic acid (2-4 h). However, only formation of products **11b-e** was observed in all cases. The highest yields were achieved under the optimal conditions noted above for the synthesis of compounds **10-13**.

The composition and structure of the synthesized compounds **10a-e** – **13a-e** were confirmed by the results of elemental analyses (Table 1) and by IR and ^{1}H NMR spectral data (Tables 2 and 3).

The IR spectra of these compounds contained absorption bands for the C=O, C=N, and C–N groups in the regions of 1651-1670, 1531-1596, and 1466-1514 cm^{-1} respectively, being in agreement with literature data [10, 12].

The basic differences between the ^{1}H NMR spectra of the products **10a-e – 13a-e** and those of the starting materials **5-8** are the absence of signals for the H-8 protons and the presence of signals of the =CHAr(Het) group. In addition, the multiplicity of the signals of H-7 proton takes the form of a triplet of doublets with a coupling constant (J = 2.4-2.7 Hz) to the protons of the =CHAr(Het) group, as noted previously

TABLE 1. Characteristics of the Compounds Synthesized

Compound	Empirical formula	Found N, % / Calculated N, %	R_f*	mp, °C (benzene)	Yield, %
10a	$C_{18}H_{16}N_2OS$	8.91 / 9.09	0.87	225-227	69
10b	$C_{20}H_{21}N_3OS$	11.87 / 11.96	0.75	260-261	65
10c	$C_{20}H_{20}N_2O_3S$	7.51 / 7.60	0.59	249-250	64
10d	$C_{19}H_{16}N_2O_3S$	8.04 / 7.95	0.81	233-235	68
10e	$C_{16}H_{14}N_2O_2S$	9.50 / 9.39	0.67	264	89
11a	$C_{19}H_{16}N_2OS$	8.66 / 8.75	0.81	250	72
11b	$C_{21}H_{21}N_3OS$	11.69 / 11.57	0.84	274-275	71
11c	$C_{21}H_{20}N_2O_3S$	7.45 / 7.36	0.68	242-244	64
11d	$C_{20}H_{16}N_2O_3S$	7.54 / 7.69	0.83	260-262	65
11e	$C_{17}H_{14}N_2O_2S$	8.90 / 9.03	0.83	242*[2]	93
12a	$C_{20}H_{18}N_2OS$	8.23 / 8.38	0.87	238-240	79
12b	$C_{22}H_{23}N_3OS$	11.22 / 11.14	0.79	264-266	68
12c	$C_{22}H_{22}N_2O_3S$	6.98 / 7.13	0.80	253-255	72
12d	$C_{21}H_{18}N_2O_3S$	7.23 / 7.40	0.89	278-280	66
12e	$C_{18}H_{16}N_2O_2S$	8.80 / 8.64	0.77	236-238	96
13a	$C_{21}H_{20}N_2OS$	7.90 / 8.04	0.87	233-235	61
13b	$C_{23}H_{25}N_3OS$	10.59 / 10.74	0.90	263-265	71
13c	$C_{23}H_{24}N_2O_3S$	6.99 / 6.86	0.86	230-231	78
13d	$C_{22}H_{20}N_2O_3S$	7.01 / 7.14	0.83	254-255	84
13e	$C_{19}H_{18}N_2O_2S$	8.09 / 8.28	0.88	241-242	90

* Systems for TLC: benzene–methanol 5:1 (compounds **10a-e**, **11a**,**c**,**d**, **12a-e**, **13a-e**), benzene–methanol 3:1 (compounds **11b**,**e**).

*[2] Compound **11e** was recrystallized from a benzene–hexane 2:1 mixture.

[10, 20-22, 25]. The spectra of compounds **10b**,**c** are exceptional: the signals of H-7 protons are triplets, and the methyne protons are broad singlets, as was noted [26] for 3-dimethylaminomethylidene-1,2,3,9-tetrahydropyrrolo[2,1-*b*]quinazolone-4. One should also note the shifts of the signals of H-6 and H-7 protons to weak field by 0.1 in the first case and 1 ppm in the second case.

TABLE 2. IR Spectra of the Compounds Synthesized

Compound	ν, cm^{-1}			Compound	ν, cm^{-1}		
	C=O	C=N	C–N		C=O	C=N	C–N
10a	1664	1575	1507	**12a**	1652	1570	1475
10b	1651	1538	1467	**12b**	1652	1570	1475
10c	1664	1576	1514	**12c**	1668	1596	1470
10d	1668	1551	1503	**12d**	1661	1546	1488
10e	1653	1553	1509	**12e**	1656	1552	1475
11a	1656	1572	1490	**13a**	1670	1582	1470
11b	1659	1531	1475	**13b**	1660	1552	1481
11c	1668	1577	1466	**13c**	1662	1579	1466
11d	1668	1533	1489	**13d**	1661	1546	1488
11e	1663	1542	1474	**13e**	1661	1554	1471

TABLE 3. ^{1}H NMR Spectra of the Compounds Synthesized

Compound	Chemical shifts, ppm (*J*, Hz)*
1	2
10a	2.33 (3H, s, 2-CH_3); 2.43 (3H, s, 3-CH_3); 3.24 (2H, td, *J* = 6.5, *J* = 2.8, H-7); 4.19 (2H, t, *J* = 6.5, H-6); 7.29-7.47 (5H, m, H Ph); 7.64 (1H, t, *J* = 2.8, CHPh)
10b	2.09 (3H, s, 2-CH_3); 2.11 (3H, s, 3-CH_3); 3.06 (6H, s, $N(CH_3)_2$); 3.16 (2H, t, *J* = 6.5, H-7); 4.23 (2H, t, *J* = 6.5, H-6); 7.37 (2H, d, *J* = 8.9, H-3,5 Ar); 7.44 (2H, d, *J* = 8.9, H-2,6 Ar); 7.54 (1H, br. s, CHAr)
10c	2.07 (3H, s, 2-CH_3); 2.09 (3H, s, 3-CH_3); 3.16 (2H, t, *J* = 6.8, H-7); 3.58 (6H, s, $2OCH_3$); 4.19 (2H, t, *J* = 6.8, H-6); 6.72 (1H, d, *J* = 8.6, H-5 Ar); 6.80 (1H, d, *J* = 2.0, H-2 Ar); 6.95 (1H, dd, *J* = 8.6, *J* = 2.0, H-6 Ar); 7.43 (1H, br. s, CHAr)
10d	2.32 (3H, s, 2-CH_3); 2.42 (3H, s, 3-CH_3); 3.18 (2H, td, *J* = 6.7, *J* = 2.7, H-7); 4.17 (2H, t, *J* = 6.7, H-6); 5.96 (2H, s, OCH_2); 6.80 (1H, d, *J* = 8.0, H-5 Ar); 6.95 (1H, d, *J* = 1.8, H-2 Ar); 6.98 (1H, dd, *J* = 8.0, *J* = 1.8, H-6 Ar); 7.54 (1H, t, *J* = 2.7, CHAr)
10e	2.06 (3H, s, 2-CH_3); 2.09 (3H, s, 3-CH_3); 3.19 (2H, td, *J* = 7.2, *J* = 2.4, H-7); 4.16 (2H, t, *J* = 7.2, H-6); 6.28 (1H, dd, *J* = 3.4, *J* = 1.7, H-4 Het); 6.63 (1H, d, *J* = 3.4, H-3 Het); 7.27 (1H, t, *J* = 2.4, CHHet); 7.38 (1H, d, *J* = 1.7, H-5 Het)
11a	2.37-2.43 (2H, m, 2-$CH_2C\underline{H}_2$); 2.90 (2H, t, *J* = 7.0, 2-CH_2); 3.02 (2H, t, *J* = 7.0, 3-CH_2); 3.25 (2H, td, *J* = 7.2, *J* = 2.7, H-7); 4.20 (2H, t, *J* = 7.2, H-6); 7.30-7.47 (5H, m, H Ph); 7.65 (1H, t, *J* = 2.7, CHPh)
11b	2.39-2.41 (2H, m, 2-$CH_2C\underline{H}_2$); 2.90 (2H, t, *J* = 7.0, 2-CH_2); 3.03 (6H, s, $N(CH_3)_2$); 3.10 (2H, t, *J* = 7.0, 3-CH_2); 3.23 (2H, td, *J* = 7.2, *J* = 2.6, H-7); 4.21 (2H, t, *J* = 7.2, H-6); 6.85 (2H, d, *J* = 8.9, H-3,5 Ar); 7.43 (2H, d, *J* = 8.9, H-2,6 Ar); 7.60 (1H, t, *J* = 2.6, CHAr)
11c	2.38-2.41 (2H, m, 2-$CH_2C\underline{H}_2$); 2.89 (2H, t, *J* = 7.1, 2-CH_2); 3.01 (2H, t, *J* = 7.3, 3-CH_2); 3.23 (2H, td, *J* = 6.7, *J* = 2.8, H-7); 3.86, 3.87 (3H, s and 3H, s, OCH_3); 4.21 (2H, t, *J* = 6.7, H-6); 6.87 (1H, d, *J* = 8.3, H-5 Ar); 6.98 (1H, d, *J* = 2.0, H-2 Ar); 7.08 (1H, dd, *J* = 8.3, *J* = 2.0, H-6 Ar); 7.60 (1H, t, *J* = 2.8, CHAr)
11d	2.38-2.41 (2H, m, 2-$CH_2C\underline{H}_2$); 2.89 (2H, t, *J* = 6.9, 2-CH_2); 3.02 (2H, t, *J* = 7.3, 3-CH_2); 3.20 (2H, td, *J* = 7.1, *J* = 2.8, H-7); 4.19 (2H, t, *J* = 7.1, H-6); 5.96 (2H, s, OCH_2); 6.81 (1H, d, *J* = 8.0, H-5 Ar); 6.96 (1H, d, *J* = 1.6, H-2 Ar); 6.98 (1H, dd, *J* = 8.0, *J* = 1.6, H-6 Ar); 7.56 (1H, t, *J* = 2.8, CHAr)
11e	2.37-2.40 (2H, m, 2-$CH_2C\underline{H}_2$); 2.90 (2H, t, *J* = 7.2, 2-CH_2); 3.01 (2H, t, *J* = 7.3, 3-CH_2); 3.27 (2H, td, *J* = 6.8, *J* = 2.7, H-7); 4.18 (2H, t, *J* = 6.8, H-6); 6.46 (1H, dd, *J* = 3.4, *J* = 1.7, H-4 Het); 6.52 (1H, d, *J* = 3.4, H-3 Het); 7.40 (1H, t, *J* = 2.7, CHHet); 7.50 (1H, d, *J* = 1.7, H-5 Het)

TABLE 3 (continued)

1	2
12a	1.76-1.84 (4H, m, 2-$CH_2(C\underline{H}_2)_2$); 2.72 (2H, t, *J* = 6.1, 2-CH_2); 2.97 (2H, t, *J* = 6.1, 3-CH_2); 3.24 (2H, td, *J* = 6.6, *J* = 2.9, H-7); 4.18 (2H, t, *J* = 6.6, H-6); 7.27-7.48 (5H, m, H Ph); 7.64 (1H, t, *J* = 2.9, CHPh)
12b	1.76-1.83 (4H, m, 2-$CH_2(C\underline{H}_2)_2$); 2.70 (2H, t, *J* = 5.8, 2-CH_2); 2.96 (6H, s, $N(CH_3)_2$); 2.98 (2H, t, *J* = 5.4, 3-CH_2); 3.19 (2H, td, *J* = 7.1, *J* = 2.6, H-7); 4.15 (2H, t, *J* = 7.1, H-6); 6.66 (2H, d, *J* = 9.0, H-3,5 Ar); 7.38 (2H, d, *J* = 9.0, H-2,6 Ar); 7.56 (1H, t, *J* = 2.6, CHAr)
12c	1.78-1.82 (4H, m, 2-$CH_2(C\underline{H}_2)_2$); 2.71 (2H, t, *J* = 6.0, 2-CH_2); 2.96 (2H, t, *J* = 6.0, 3-CH_2); 3.22 (2H, td, *J* = 7.2, *J* = 2.7, H-7); 3.86, 3.87 (3H, s and 3H, s, OCH_3); 4.18 (2H, t, *J* = 7.2, H-6); 6.87 (1H, d, *J* = 8.4, H-5 Ar); 7.0 (1H, d, *J* = 1.9, H-2 Ar); 7.08 (1H, dd, *J* = 8.4, *J* = 1.9, H-6 Ar); 7.58 (1H, t, *J* = 2.7, CHAr)
12d	1.77-1.82 (4H, m, 2-$CH_2(C\underline{H}_2)_2$); 2.71 (2H, t, *J* = 6.0, 2-CH_2); 2.96 (2H, t, *J* = 6.0, 3-CH_2); 3.19 (2H, td, *J* = 7.1, *J* = 2.8, H-7); 4.17 (2H, t, *J* = 7.1, H-6); 5.96 (2H, s, OCH_2); 6.81 (1H, d, *J* = 8.0, H-5 Ar); 6.95 (1H, d, *J* = 1.4, H-2 Ar); 6.98 (1H, dd, *J* = 8.0, *J* = 1.4, H-6 Ar); 7.55 (1H, t, *J* = 2.8, CHAr)
12e	1.77-1.82 (4H, m, 2-$CH_2(C\underline{H}_2)_2$); 2.70 (2H, t, *J* = 6.0, 2-CH_2); 2.96 (2H, t, *J* = 6.0, 3-CH_2); 3.26 (2H, td, *J* = 7.1, *J* = 2.8, H-7); 4.16 (2H, t, *J* = 7.1, H-6); 6.45 (1H, dd, *J* = 3.4, *J* = 1.7, H-4 Het); 6.51 (1H, d, *J* = 3.4, H-3 Het); 7.40 (1H, t, *J* = 2.8, CHHet); 7.49 (1H, d, *J* = 1.7, H-5 Het)
13b	1.62-1.66 (4H, m, 2-$CH_2(C\underline{H}_2)_2$); 1.81-1.83 (2H, m, 3-$CH_2C\underline{H}_2$); 2.77 (2H, t, *J* = 5.8, 2-CH_2); 2.97 (6H, s, $N(CH_3)_2$); 3.20 (2H, td, *J* = 6.6, *J* = 2.6, H-7); 3.29 (2H, t, *J* = 5.5, 3-CH_2); 4.16 (2H, t, *J* = 6.6, H-6); 6.66 (2H, d, *J* = 9.0, H-3,5 Ar); 7.38 (2H, d, *J* = 9.0, H-2,6 Ar); 7.55 (1H, t, *J* = 2.6, CHAr)
13c	1.63-1.67 (4H, m, 2-$CH_2(C\underline{H}_2)_2$); 1.82-1.84 (2H, m, 3-$CH_2C\underline{H}_2$); 2.78 (2H, t, *J* = 5.6, 2-CH_2); 3.22 (2H, td, *J* = 6.7, *J* = 2.7, H-7); 3.29 (2H, t, *J* = 5.4, 3-CH_2); 3.86, 3.87 (3H, s and 3H, s, OCH_3); 4.19 (2H, t, *J* = 6.7, H-6); 6.87 (1H, d, *J* = 8.4, H-5 Ar); 6.98 (1H, d, *J* = 2.0, H-2 Ar); 7.10 (1H, dd, *J* = 8.4, *J* = 2.0, H-6 Ar); 7.58 (1H, t, *J* = 2.7, CHAr)
13d	1.62-1.68 (4H, m, 2-$CH_2(C\underline{H}_2)_2$); 1.81-1.84 (2H, m, 3-$CH_2C\underline{H}_2$); 2.78 (2H, t, *J* = 5.5, 2-CH_2); 3.19 (2H, td, *J* = 6.9, *J* = 2.7, H-7); 3.29 (2H, t, *J* = 5.7, 3-CH_2); 4.17 (2H, t, *J* = 6.9, H-6); 5.96 (2H, s, OCH_2); 6.81 (1H, d, *J* = 8.0, H-5 Ar); 6.96 (1H, d, *J* = 1.6, H-2 Ar); 6.98 (1H, dd, *J* = 8.0, *J* = 1.6, H-6 Ar); 7.54 (1H, t, *J* = 2.7, CHAr)
13e	1.62-1.66 (4H, m, 2-$CH_2(C\underline{H}_2)_2$); 1.81-1.83 (2H, m, 3-$CH_2C\underline{H}_2$); 2.78 (2H, t, *J* = 5.6, 2-CH_2); 3.26 (2H, td, *J* = 7.0, *J* = 2.7, H-7); 3.29 (2H, t, *J* = 5.6, 3-CH_2); 4.17 (2H, t, *J* = 7.0, H-6); 6.45 (1H, dd, *J* = 3.4, *J* = 1.8, H-4 Het); 6.51 (1H, d, *J* = 3.4, H-3 Het); 7.39 (1H, t, *J* = 2.7, CHHet); 7.49 (1H, d, *J* = 1.8, H-5 Het)

* The ^{1}H NMR spectra of compounds **10b**,**c**,**e** were recorded in trifluoroacetic acid–CD_3COOD, the remaining compounds in $CDCl_3$.

The signals of the protons of the methylene groups annelated with the thiophene ring, are practically unchanged in comparable compounds (**5-8** and **10-13**). Some differences were observed for the signals of the substituents 2-CH_3 and 3-CH_3 of compounds **10b**,**c**,**e**: they are shifted relative to the analogous signals of compound **5** to stronger field (by 0.2-0.3ppm).

Thus the interaction of the studied derivatives of 7,8-dihydropyrrolo[1,2-*a*]thieno[2,3-*d*]pyrimidin-4(6H)-one **5-8** with aromatic aldehydes and furfural occurs exclusively at the C(8)H_2 unit, which is probably related to the influence of the electron acceptor C=N group.

EXPERIMENTAL

IR spectra were recorded on an IR Fourier 2000 instrument in KBr tablets, and ^{1}H NMR spectra were recorded with a Unity 400$^+$ instrument (400 MHz) in $CDCl_3$ (compounds **5-8**) and in a trifluoroacetic acid–CD_3COOD mixture with HMDS internal standard.

Melting points were measured on Boetius (Germany) and MELTEMP (USA) blocks. The purity of the products and the course of reactions were controlled by TLC on Sorbfil (Russia) and Whatman® UV-254 plates with 2:1 benzene–hexane (compounds **5** and **6**) and 5:1 benzene–methanol (compounds **7** and **8**).

2-Amino-4,5-dimethyl- (1), 2-Amino-4,5-tri- (2), 2-Amino-4,5-tetra- (3) and **2-Amino-3-ethoxycarbonyl-4,5-pentamethylenethiophene (4)** were synthesized by a known method [12].

2,3-Dimethyl- (5) and 2,3-Tri- (6), 2,3-Tetra- (7), and 2,3-Pentamethylene-7,8-dihydropyrrolo-[1,2-*a*]thieno[2,3-*d*]pyrimidin-4(6H)-one (8) (General Method). Phosphorus oxychloride (720 mmol, ρ = 1.80 g/cm^3) was added dropwise during 0.5 h to a ice-cooled mixture of a substituted thiophene **1-4** (200 mmol) and γ-butyrolactam (300 mmol). The reaction mixture was kept for 2 h in a water bath, then for 16 h at room temperature, then poured into crushed ice and made basic to pH 9 with ammonia solution. The precipitate was filtered off, washed several times with water, dried, and recrystallized from the corresponding solvent.

Compound 5. Yield 86%; mp 144-145°C (hexane) (mp 144-145°C [10]), R_f 0.70. ^{1}H NMR spectrum, δ, ppm (*J*, Hz): 2.18-2.24 (2H, m, H-7); 2.30 (3H, s, 2-CH_3); 2.41 (3H, s, 3-CH_3); 3.07 (2H, t, *J* = 8.1, H-8); 4.10 (2H, t, *J* = 7.1, H-6).

Compound 6. Yield 90%; mp 202-204°C (methanol) (mp 200°-201°C [4]), R_f 0.65. ^{1}H NMR spectrum, δ, ppm (*J*, Hz): 2.19-2.25 (2H, m, H-7); 2.35-2.41 (2H, m, 2-$CH_2\underline{CH_2}$); 2.87 (2H, t, *J* = 7.1, 2-CH_2); 3.0 (2H, t, *J* = 7.1, 3-CH_2); 3.10 (2H, t, *J* = 8.0, H-8); 4.11 (2H, t, *J* = 7.2, H-6).

Compound 7. Yield 82%; mp 215-217°C (ethanol) (mp 212-214°C [4]), R_f 0.43. ^{1}H NMR spectrum, δ, ppm (*J*, Hz): 1.75-1.81 (4H, m, 2-$CH_2(C\underline{H_2})_2$); 2.19-2.24 (2H, m, H-7); 2.69 (2H, t, *J* = 5.8, 2-CH_2); 2.94 (2H, t, *J* = 6.2, 3-CH_2); 3.07 (2H, t, *J* = 7.9, H-8); 4.09 (2H, t, *J* = 7.3, H-6).

Compound 8. Yield 96%; mp 156-158°C (heptane) (mp 156-158°C [4]), R_f 0.74. ^{1}H NMR spectrum, δ, ppm (*J*, Hz): 1.59-1.62 (4H, m, 2-$CH_2(C\underline{H_2})_2$); 1.82 (2H, m, 3-$CH_2C\underline{H_2}$); 2.18-2.24 (2H, m, H-7); 2.76 (2H, t, *J* = 5.7, 2-CH_2); 3.07 (2H, t, *J* = 7.9, H-8); 3.27 (2H, t, *J* = 5.7, 3-CH_2); 4.10 (2H, t, *J* = 7.3, H-6).

2,3-Dimethyl- (10a-e) and 2,3-Trimethylene- (11a-e), 2,3-Tetramethylene- (12a-e) and 2,3-Pentamethylene-substituted 8-Arylidenedihydropyrrolo[1,2-*a*]thieno[2,3-*d*]pyrimidin-4-ones (13a-e) (General Method). A substituted dihydropyrrolopyrimidinone **5-8** (2.0 mmol) and an aldehyde **9a-e** (2.0 mmol) were added to a solution of NaOH (0.6 mmol) in ethanol (10 ml). The mixture was heated on a water bath for 7-8 h. The solvent was evaporated off and the residue was recrystallized from benzene or a 2:1 benzene–hexane mixture (in the case of product **11e**).

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