REACTIONS OF HIGHLY ELECTROPHILIC POLYFLUORO UNSATURATED COMPOUNDS WITH PYRAZOLE DERIVATIVES

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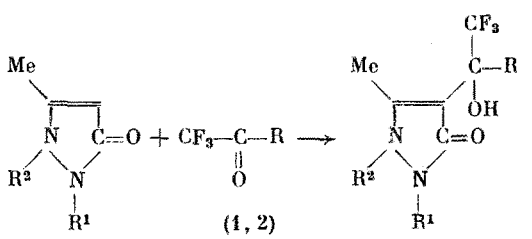
Pyrazole derivatives were hydroxyalkylated at the C^4 atom by hexafluoroacetate and methyl trifluoropyruvate. The products of the hydroxyalkylation were dehydrated to the corresponding alkylidene derivatives which were reacted with nucleophiles. Dicyanoethylenes, obtained from polyfluorocarbonyl compounds, alkylated pyrazol-5-ones with the formation of pyrazolopyran derivatives.

Keywords: *hexafluoroacetone, methyltrifluoropyruvate, 1,1-dicyano-bis-(trifluoromethyl)ethylene, methyl 3,3-dicyano-2-(trifluoromethyl)acrylate.*

It is known that hexafluoroacetone (**1**) and its imines alkylate 3-methyl-1-pyrazol-5-one at the C^4 position [1]. In the present work we have carried out a wide-ranging study of the reactions of ketone **1** and of methyl trifluoropyruvate (**2**), and of the dicyanoethylenes **3, 4** obtained from them [2, 3], with pyrazole derivatives.

Like the ketone **1**, the ketoester **2** alkylates 3-methyl-1-phenylpyrazol-5-one at the C^4 position at 20°C; the reaction product **5** can be isolated in almost quantitative yield (Table 1). 3-Methylpyrazol-5-one reacts similarly with polyfluorocarbonyl compounds **1, 2** forming products **6, 7**. Under more vigorous conditions (at bp in $CHCl_3$), ketones **1, 2** will react with 2,3-dimethyl-1-phenylpyrazol-5-one, in this case yielding products **8, 9**. The difference in reactivity is no doubt connected with the fact that pyrazolones which do not have a CH_3 group on N^2 react in hydroxy form. Saponification of the ester **9** with aqueous NaOH and subsequent acidification gave the acid **10**.



(1, 2) (5—10)

R = CF_3 (1); COOMe (2); R = COOMe, R_1 = Ph, R_2 = H (5); R = CF_3, $R^1 = R^2$ = H (6); R = COOMe, $R^1 = R^2$ = H (7); R = CF_3, R^1 = Ph, R^2 = Me (8); COOMe, Ph, Me (9); COOH, Ph, Me (10).

The substituted phenylpyrazolone **5** was also prepared from the product described earlier [4] of the hydroxyalkylation of the acetoacetic ester **11** and phenylhydrazine.* Condensation is carried out initially for 12 h at 20°C followed by heating for 2 h at 95°C. The yield of the product **5** in this case was 78%.

*For preliminary communication, see [5].

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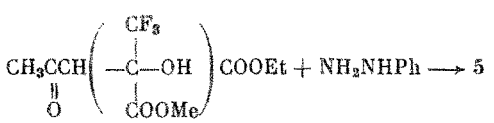
TABLE 1. Properties of Compounds **5-10, 12-17, 19, 20, 22-24**

Compound	Yield, %	mp, °C	R_f (CCl_4 – acetone)	Found / Calculated, % C	H	N	Empirical formula
5	93	173 (EA) *	0.32 (3 : 1)	50.84 50.90	4.05 3.94	8.22 8.48	$C_{14}H_{13}F_3N_2O_4$
6	91	235 (water)	0.51 (1 : 1)	31.86 31.82	2.21 2.27	10.57 10.61	$C_7H_6F_6N_2O_2$
7	94	158–159 (water)	0.32 (1 : 1)	37.42 37.80	3.45 3.54	10.92 11.02	$C_8H_9F_3N_2O_4$
8	100	121–123 †	0.52 (3 : 1)	47.18 47.46	3.47 3.39	8.07 7.91	$C_{14}H_{12}F_6N_2O_4$
9	98	170 (benzene)	0.52 (2 : 1)	51.96 52.33	4.05 4.36	8.17 8.14	$C_{15}H_{15}F_3N_2O_4$
10	94	171–173(toluene)	0.40 (2 : 1)	50.53 50.91	3.87 3.93	8.28 8.48	$C_{14}H_{13}F_3N_2O_4$
12	90	202–205 (EA)	0.61 (3 : 1)	46.00 46.02	3.40 3.24	12.39 12.38	$C_{13}H_{11}F_6N_3O$
13	84	200–202 (EA)	0.43 (2 : 1)	51.01 51.06	4.04 4.26	12.89 12.77	$C_{14}H_{15}F_3N_3O_3$
14	100	193–194 †	0.48 (3 : 1)	52.46 52.40	3.70 3.49	11.91 12.23	$C_{20}H_{16}F_6N_4O_2$
15	100	163–165 †	0.30 (2 : 1)	55.72 56.25	4.40 4.24	12.00 12.50	$C_{21}H_{19}F_3N_4O_4$
16	84	181–183 (water)	–	28.71 28.92	1.70 2.00	16.77 16.86	$C_6H_5N_3F_6O$
17	70	203–204 (decomp.)	–	42.57 42.86	4.44 4.37	10.98 11.11	$C_9H_{11}F_3N_2O_3$
19	76	82 (pentane)	–	48.65 48.44	2.49 2.48	8.33 8.70	$C_{13}H_8F_6N_2O$
20	82	116 (pentane)	–	54.27 53.85	3.49 3.53	9.32 8.97	$C_{14}H_{11}F_3N_2O_3$
22	67	167–169 (EA)	0.70 (2 : 1)	48.67 49.23	4.02 4.36	6.51 7.18	$C_{16}H_{17}F_3N_2O_4S$
23	95 ‡	192–193 (CCl_4)	0.64 (3 : 1)	49.30 49.48	2.39 2.58	14.13 14.43	$C_{16}H_{10}F_6N_4O$
24	70	158–159 (CCl_4)	0.38 (3 : 1)	54.15 53.97	3.39 3.44	15.03 14.81	$C_{17}H_{13}F_3N_4O_3$

*EA = ethyl acetate.

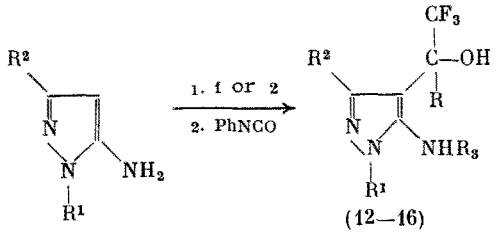
†1:1 EA–pentane.

‡Yield according to method B.



(11)

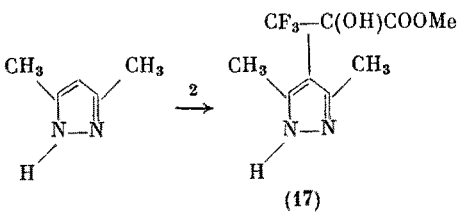
5-Amino-3-methyl-1-phenylpyrazole reacts similarly to phenylpyrazolones with polyfluorocarbonyl compounds. The C^4-alkylation products **12, 13** so formed readily add phenyl isocyanate forming the ureas **14, 15**. In the case of 3-aminopyrazole, the presence of the relatively highly active amidine fragment complicates the process of C-hydroxyalkylation by polyfluorocarbonyl compounds [6] and whereas in the case of ketone **1** it is possible to obtain **16** in high yield, reaction of 3-aminopyrazole with the ketoester **2** forms a mixture of unidentified products



(12–16)

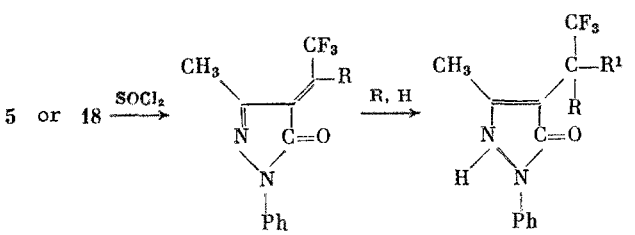
R = CF_3, R^1 = Ph, R^2 = CH_3, R^3 — H (12); COOMe, Ph, CH_3, H (13); CF_3, Ph, CH_3, PhNHC(O) (14); COOMe, Ph, CH_3, PhNHC(O) (15); CF_3, R^1 = R^2 = H (16).

As should be expected, 3,5-dimethylpyrazole is C^4-hydroxyalkylated by the ketoester **2** considerably more slowly than 3-methyl-1-phenylpyrazol-5-one, 3-methylpyrazol-5-one, and 5-amino-3-methyl-1-phenylpyrazole. The reaction product was obtained in 70% yield after 36 h at bp in $CHCl_3$.



(17)

The 4-(1-hydroxy-1-trifluoromethyl-2,2,2-trifluoroethyl)-3-methyl-1-phenylpyrazol-5-one (**18**) which we prepared earlier [1] is dehydrated on heating with $SOCl_2$ in benzene and on subsequent treatment with aqueous $NaHCO_3$ forms the deep violet colored derivative **19**. A similar conversion of **5** leads to a mixture of *E*- and *Z*-isomers in which, according to the NMR spectroscopic results, the *E*-isomer (**20**) predominates (96.4%) and is obtained in pure form after recrystallization.

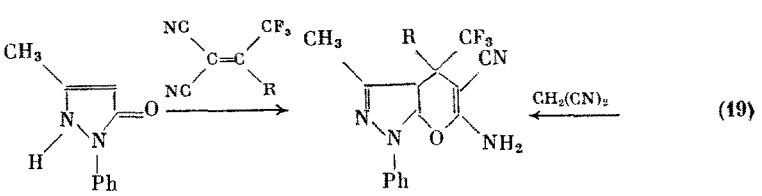


(19, 20) (21, 22)

R = CF_3 (19); COOMe (20); CF_3, R^1 = NH_2 (21); COOMe, $-SCH_2CH_2OH$ (22).

By analogy with the results of [7, 8], treatment of the alkylidene derivative **13** with ammonia at 20°C gave the amino derivative **21** which can also be prepared by aminoalkylation of 3-methyl-1-phenylpyrazol-5-one by the imines of hexafluoroacetone [1]. Aniline does not react with **19** at 70°C. The alkylidene derivatives **19, 20** also fail to react with ethanol at bp although mercaptoethanol adds to the double bond of **20** with the formation of the sulfide **22**.

Reaction of the alkylidene derivative **19** with malononitrile in the presence of triethylamine at 20°C gives an almost quantitative yield of pyrazolopyran **23**; this can also be prepared from 3-methyl-1-phenylpyrazol-5-one and 1,1-dicyano-2,2-bis-(trifluoromethyl)ethylene (**3**). When another highly electrophilic reagent — methyl 3,3-dicyano-2-(trifluoromethyl)acrylate (**4**) — is used the pyrazolopyran **24**, containing a methoxycarbonyl group, is obtained. The heterocyclization of 3-aminopyrazole with alkenes **3, 4**, which gives pyrazolopyran derivatives, has been reported previously [3, 9].



(23, 24). (19)

R = CF_3 (3, 23); COOMe (4, 24).

The structure of the compounds prepared has been established on the basis of their ^1H and ^{19}F NMR spectra (Table 2) and their ^{13}C NMR spectra reported in the experimental section. The configuration of the alkylidene derivative **20** was

TABLE 2. ^1H and ^{19}F NMR Spectra (δ, ppm, *J*, Hz) of Compounds **5-10, 12-17, 19, 20, 22-24**

Compound	Solvent	^1H		^{19}F
		CH_3	other protons	
5	Acetone-d_6	2.28 s	3.85 s (3H, CH_3); 7.24–7.76 (5H, Ph)	−0.8 s
6	ditto	2.20 s	–	−1.7 s
7	»	2.22 s	3.81 s (3H, CH_3)	−0.4 s
8	»	2.42 s	3.45 s (3H, N−CH_3); 7.38–7.63 (5H, Ph)	−1.08 s
9	»	2.34 s	3.34 s (3H, N−CH_3); 3.81 s (3H, OCH_3); 7.39–7.64 (5H, Ph)	0.53 s
10	»	2.61 s	3.56 s (3H, N−CH_3); 7.47–7.69 s (5H, Ph)	1.02 s
12	DMSO-d_6	2.13 s	5.35 br.s (2H, NH_2); 7.35–7.6 (5H, Ph); 8.87 s (1H, OH)	−3.4 s
13	ditto	1.97 s	3.85 s (3H, OCH_3); 5.22 br.s (2H, NH_2); 7.35–7.63 (5H, Ph); 8.12 s (1H, OH)	−0.4 s
14	»	2.37 s	6.87–7.42 (10H, 2Ph); 7.85 s, 8.47 s, 8.84 s (2NH and OH)	−3.9 s
15	»	2.30 s	3.67 s (3H, OCH_3); 6.87–7.57 (10H, 2Ph); 7.83 s (2H, 2NH); 8.67 s (1H, OH)	−1.2 s
16	Acetone-d_6	–	7.91 (1H, CH)	0.56 s
17	DMSO-d_6	2.23 s (6H, 2×CH_3)	3.87 s (3H, OCH_3); 6.97 (2H, NH and OH) 7.18–7.83 (5H, Ph)	−1.02 s
19	Acetone-d_6	2.35 q ($^6J_{C-F}$=2)		See experimental section
20 *	Acetone-d_6	2.18 q ($^6J_{C-F}$=2)	3.87 s (3H, OCH_3); 7.12–7.68 (5H, Ph)	−21.45 q ($^6J_{C-F}$=2.0)
22	DMSO-d_6	2.36 s	2.66 and 2.86 m (2H, S−CH_2); 3.56 m (3H, $HOCH_2$); 3.71 s (3H, OCH_3); 7.19–7.60 (5H, Ph)	−7.7 s
23	Acetone-d_6	2.27 s	7.40–7.77 (5H, Ph); 8.33 br.s (2H, NH_2)	−13.9 s
24	DMSO-d_6	2.11 s	3.86 s (3H, OCH_3); 7.36–7.79 (5H, Ph); 8.14 br.s (2H, NH_2)	−10.3 s

*^1H and ^{19}F NMR spectra of *E*-isomer of **20**.

established from its ^{19}F and ^1H NMR spectra. Thus, in the PMR spectrum the CH_3 group appeared as a quartet split on the CF_3 group with $^6J_{H-F}$ = 2.0 Hz. Such a value of long-range H−F spin−spin coupling can be explained by spin−spin interaction "across space" [10]. In other words, the interacting nuclei must be close in space and this can be realized only for the *E*-configuration. This deduction is supported by the ^{19}F NMR spectrum of compound **19** (see the Experimental section). The physicochemical properties of the compounds prepared and their elementary analyses are set out in Table 1. Compounds **5-10, 12-18, 22-24** were white crystals and compound **20**, red crystals.

EXPERIMENTAL

^1H, ^{19}F, and ^{13}C NMR spectra were run on Bruker WP-200SY and Bruker AC-200 spectrometers at working frequencies of 200.13, 188.31, and 50.31 MHz, respectively. TMS was used as internal standard for ^1H and ^{13}C spectra, and CF_3COOH as external standard for ^{19}F. Mass spectra were obtained on an AEI MS-30 instrument. R_f values are quoted for Silufol UV-254 plates, the compounds being revealed by UV absorption.

4-(1-Hydroxy-1-methoxycarbonyl-2,2,2-trifluoroethyl)-1-phenyl-3-methylpyrazol-5-one (5). *Method A.* To a solution of 5.0 g (0.029 mole) 1-phenyl-3-methylpyrazol-5-one in 20 ml CH_2Cl_2 was added gradually, while cooling to 5°C, 5.15 g (0.033 mole) ketoester **2** in 15 ml CH_2Cl_2. After stirring 0.5 h a white deposit of product **5** was observed; the suspension was stirred for a further 1 h and the product was filtered off. A further quantity of product was obtained by cooling the mother liquor. The yield of **5** was 8.8 g. ^{13}C NMR spectrum (DMSO-d_6, δ, ppm, *J*, Hz); 14.57 (CH_3), 54.48 (OCH_3), 76.93 q (C−CF_3, $^2J_{C-F}$ = 29.7), 110.40 (C^4), 121.72, 127.40, 131.09, and 138.52 (Ph), 124.60 q (CF_3, $^1J_{C-F}$ = 288), 151.02 (C^3), 169.55 (C^5), 169.57 (COO).

Method B. To a solution of 2.86 g (0.01 mole) methyl-2-hydroxy-2-trifluoromethyl-3-acetylsuccinic acid (**11**) in 70 ml benzene was added gradually, while cooling to 5°C, 1.1 g (0.01 mole) phenylhydrazine in 15 ml benzene. The reaction mixture was kept for 12 h at 20°C and the benzene then evaporated in vacuum and the residue heated 2 h on a boiling-water bath. On

cooling to 20°C the residue crystallized. The crystals were washed with 15 ml $CHCl_3$ and recrystallized from ethyl acetate. The yield was 2.57 g compound **5** the physicochemical properties of which fully coincided with those of the product obtained by method A.

4-(1-Hydroxy-1-trifluoromethyl-2,2,2-trifluoroethyl)-3-methylpyrazol-5-one (6). In a glass ampul was placed 1.96 g (0.02 mole) 3-methylpyrazol-5-one in 10 ml acetonitrile, the ampul cooled to −60°C and 3.5 g (0.021 mole) ketone **1** condensed in. The ampul was sealed and kept at 20°C. After 24 h the solvent was removed in vacuum to yield 4.8 g **6**. ^{13}C NMR spectrum (acetonitrile-d_3, δ, ppm, *J*, Hz): 12.50 (CH_3), 76.54 septet ($-C(CF_3)_2$), 90.70 (C^4), 123.78 q (CF_3, $^1J_{C-F}$ = 286.0), 142.72 (C^3), 162.12 (C^5).

4-(1-Hydroxy-1-methoxycarbonyl-2,2,2-trifluoroethyl)-3-methylpyrazol-5-one (7). To a solution of 1.96 g (0.02 mole) 3-methylpyrazol-5-one in 10 ml acetonitrile was added gradually 3.12 g (0.02 mole) ketoester **2**. The reaction mixture was kept for 16 h at 20°C and then evaporated in vacuum to yield 4.78 g compound **7**. ^{13}C NMR spectrum (DMSO-d_6, δ, ppm, *J*, Hz): 11.53 (CH_3), 52.43 (OCH_3), 74.91 q ($C-CF_3$, $^2J_{C-F}$ = 29.2), 124.65 q (CF_3, $^1J_{C-F}$ = 285.8), 140.25 (C^3), 159.11 (C^5), 168.12 (COO).

4-(1-Hydroxy-1-trifluoromethyl-2,2,2-trifluoroethyl)-2,3-dimethyl-1-phenylpyrazol-5-one (8). In a glass ampul was placed 5.0 g (0.027 mole) 2,3-dimethyl-1-phenylpyrazol-5-one in 15 ml $CHCl_3$, the ampul cooled to −60°C, and 6.0 g (0.036 mole) ketone **1** condensed into it. The ampul was sealed and kept for 24 h at 20°C and then heated at 75°C for 3 h. After cooling, the ampul was opened and the excess ketone and solvent removed under vacuum. The yield was 9.4 g compound **8**. ^{13}C NMR spectrum (DMSO-d_6, δ, ppm, *J*, Hz): 11.71 (CH_3), 33.93 ($N-CH_3$), 76.43 septet ($C-(CF_3)_2$), 90.34 (C^4), 123.00 q (CF_3, $^1J_{C-F}$ = 285.6), 126.77, 128.89, 129.51, 132.53 (Ph), 150.37 (C^3), 164.05 (C^5).

4-(1-Hydroxy-1-methoxycarbonyl-2,2,2-trifluoroethyl)-2,3-dimethyl-1-phenylpyrazol-5-one (9). To a solution of 3.0 g (0.016 mole) 2,3-dimethyl-1-phenylpyrazol-5-one in 15 ml $CHCl_3$ at 20°C was added gradually a solution of 3.9 g (0.025 mole) ketoester **2** in 15 ml $CHCl_3$. The mixture was kept 16 h at 20°C, boiled for 2 h, cooled and evaporated in vacuum to yield 5.4 g compound **9**.

4-(1-Hydroxyl-1-carboxy-2,2,2-trifluoroethyl)-2,3-dimethyl-1-phenylpyrazol-5-one (10). To a suspension of 2.0 g (5.8 mmoles) compound **9** in 10 ml water was added gradually a solution of 0.5 g NaOH in 10 ml water. As the alkali was added the initial **9** was seen to dissolve. The mixture was kept 8 h at 20°C and then acidified to pH 2 by the addition of 5% aqueous HCl. The precipitate which formed was filtered off to give 1.8 g compound **10**.

4-(1-Hydroxy-1-trifluoromethyl-2,2,2-trifluoroethyl)-3-methyl-1-phenyl-5-aminopyrazole (12). In a glass ampul was placed 3.0 g (17 mmoles) 3-methyl-1-phenyl-5-aminopyrazole in 20 ml $CHCl_3$, the ampul cooled to −60°C and 3.0 g (18 mmoles) ketone **1** condensed in. The ampul was sealed and kept for 5 h at 20°C. The white crystalline deposit was filtered off to yield 5.3 g compound **12**. Mass spectrum, *m/z*: 339 M^+.

4-(1-Hydroxy-1-methoxycarbonyl-2,2,2-trifluoroethyl)-3-methyl-1-phenyl-5-aminopyrazole (13). To a solution of 1.0 g (5.8 mmoles) 3-methyl-1-phenyl-5-aminopyrazole in 15 ml $CHCl_3$ was added gradually a solution of 1.0 g (6.4 mmoles) ketoester **2** in 15 ml $CHCl_3$. The resulting suspension was stirred for 3 h and the precipitate filtered off. Yield 1.6 g compound **13**. Mass spectrum, *m/z*: 329 M^+.

1-Phenyl-3-(1-phenyl-3-methyl-4-(1-hydroxy-1-trifluoromethyl-2,2,2-trifluoroethyl)pyrazol-2-yl)urea (14). To a solution of 2.0 g (5.9 mmoles) compounds **12** in 15 ml acetonitrile was added 0.7 g (5.9 mmoles) phenylisocyanate in 10 ml acetonitrile. The reaction mixture was kept for 12 h and then evaporated in vacuum to yield 2.7 g compound **14**.

1-Phenyl-3-(1-phenyl-3-methyl-4-(1-hydroxy-1-methoxycarbonyl-2,2,2-trifluoroethyl)pyrazol-2-yl)urea (15). Prepared in a similar manner to **14**.

4-(1-Hydroxy-1-trifluoromethyl-2,2,2-trifluoroethyl)-3-aminopyrazole (16). In a glass ampul was placed 2.0 g (2.4 mmoles) 3-aminopyrazole in 20 ml acetonitrile, the ampul cooled to −60°C and 4.1 g (24.7 mmoles) ketone **1** condensed in. The ampul was sealed, kept for 24 h at 20°C, opened, and the mixture evaporated in vacuum. The residue was treated with 50 ml water and the crystals filtered off to yield 5.6 g compound **16**. Mass spectrum, *m/z*: 249 M^+.

4-(1-Hydroxy-1-methoxycarbonyl-2,2,2-trifluoroethyl)-3,5-dimethylpyrazole (17). To a solution of 1.2 g (12.5 mmoles) 3,5-dimethylpyrazole in 15 ml $CHCl_3$ at 20°C was added gradually a solution of 1.95 g (12.5 mmoles) ketoester **2** in 15 ml $CHCl_3$. The mixture was heated at bp for 36 h and the precipitated producted filtered off. Yield 2.2 g compound **17**. ^{13}C NMR spectrum (DMSO-d_6, δ, ppm, *J*, Hz): 11.48 (CH_3), 52.21 (OCH_3), 75.41 q ($C-CF_3$, $^2J_{C-F}$ = 29.0), 108.08 (C^4), 124.25 q (CF_3, $^1J_{C-F}$ = 283.5), 142.17 (C^3 and C^5), 168.08 (COO).

4-(1-Trifluoromethyl-2,2,2-trifluoroethylidene)-1-phenyl-3-methyl-pyrazol-5-one (19). To a suspension of 2.0 g (5.9 mmoles) compound **18** in 50 ml benzene was added 1.4 g (7.1 mmoles) $SOCl_2$. The mixture was heated at bp until TLC showed

that the initial **18** had all reacted. The resulting light yellow homogeneous mixture was cooled to 20°C and poured into saturated aqueous $NaHCO_3$; the benzene layer acquired a deep violet color. The benzene layer was separated, dried over $CaCl_2$, and evaporated in vacuum to give 1.44 g compound **19**. ^{19}F NMR spectrum (acetone-d_6, δ, ppm, *J*, Hz): −21.7 q.q ($^4J_{F-F}$ = 10.0, $^6J_{H-F}$ = 2.0), −19.3 q ($^4J_{F-F}$ = 10.0).

4-(1-Methoxycarbonyl-2,2,2-trifluoroethylidene)-1-phenyl-3-methylpyrazol-5-one (20) was prepared as in the preceding example from compound **5**. Compound **20** was formed as a mixture of *E*- and *Z*-isomers. The isomer ratio was found from the ratio of the integral intensities of the signals of the CF_3 group in the ^{19}F NMR spectrum: the relative integral intensities of the signals at −21.45 and at −18.70 amounted to 26.6:1. Two recrystallizations from pentane isolated the predominant isomer which was identified as the *E*-isomer on the basis of its ^1H and ^{19}F NMR spectra (Table 2) (see Discussion section above).

4-(1-Amino-1-trifluoromethyl-2,2,2-trifluoroethyl)-3-methyl-1-phenylpyrazol-5-one (21). Into a solution of 0.2 g (6.2 mmoles) compound **19** in 20 ml hexane was passed 5 ml ammonia. The violet solution lost its color as the gas was passed in. The white crystals which formed were filtered off and twice recrystallized from hexane. The yield was 0.19 g (90.8%) compound **21**, mp 142°C [1].

4-(1-Thio-β-hydroxyethyl-1-methoxycarbonyl-2,2,2-trifluoroethyl)-3-methyl-1-phenylpyrazol-5-one (22). To a solution of 0.81 g (2.6 mmoles) compound **20** in 15 ml $CHCl_3$ was added 0.23 g (2.6 mmoles) mercaptoethanol in $CHCl_3$. The reaction mixture was heated at bp for 8 h until all the color had disappeared. The product was filtered off and recrystallized from ethyl acetate to give 0.7 g compound **22**.

6-Amino-3-methyl-4,4-bis(trifluoromethyl)-1-phenyl-5-cyano-1H,4H-pyrazolo[3,4-b]pyran (23). *Method A*. To a solution of 0.5 g (2.87 mmoles) 1-phenyl-3-methylpyrazol-5-one in 5 ml acetonitrile at −20°C was added gradually a solution of 0.62 g (2.9 mmoles), 1,1-dicyano-2,2-bis(trifluoromethyl)ethylene in 5 ml acetonitrile. The reaction mixture was kept 24 h at 20°C, poured into water, and the product filtered off to give 0.7 g compound **23**.

Method B. To a solution of 0.8 g (2.5 mmoles) compound **19** in 10 ml benzene at 20°C was added with stirring a solution of 0.25 g (37.9 mmoles) malononitrile and 0.5 ml triethylamine in 10 ml benzene. The reaction mixture was kept for 12 h, passed through a column of silica gel, evaporated in vacuum, and the residue crystallized from pentane. The yield was 0.92 g compound **23**, the physicochemical properties of which coincided fully with those of compound **23** prepared by method A.

6-Amino-4-methoxycarbonyl-3-methyl-4-(trifluoromethyl)-1-phenyl-5-cyano-1H,4H-pyrazolo[3,4-b]pyran (24) was prepared in a similar manner to the preceding (method A) from 0.5 g (2.87 mmoles) 1-phenyl-3-methylpyrazol-5-one and 0.59 g (2.89 mmoles) methyl 3,3-dicyano-2-(trifluoromethyl)acrylate to yield 0.75 g compound **24**.

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