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4-Functionally-substituted 3-Heterylpyrazoles: XV.* 3-Aryl(heteryl)-1-phenyl-4-pyrazolylmethylamines and Heterocumulenes Obtained Therefrom

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Abstract—By reduction of 3-aryl(heteryl)-1-phenyl-4-azidomethyl-pyrazoles in the presence of Raney nickel or by hydrazinolysis of *N*-[3-aryl(heteryl)-1-phenyl-4-pyrazolylmethyl]phthalimides 4-pyrazolylmethylamines were obtained that in reaction with bis(trichloromethyl) carbonate afforded 3-aryl-(heteryl)-1-phenyl-4-pyrazolylmethyl isocyanates, and with carbon disulfide furnished 3-aryl-(heteryl)-1-phenyl-4-pyrazolylmethyl isothiocyanates.

In the previous paper [1] we described the synthesis and reactions with electrophilic reagents of new type secondary amines, *N*-benzyl-*N*-(4-pyrazolylmethyl)-amines. In extension of this research we report here on the synthesis and some reactions of previously virtually unknown [2] heterocyclic analogs of benzylamine, 4-pyrazolyl-methylamines. The latter look promising for purposeful creation of synthetic databases of potentially bioactive compounds.

Two preparatively convenient synthetic procedures for preparation of the target substances were developed, both using 4-chloromethylpyrazoles we had described earlier [3]. The first procedure (*a*) involves conversion of 4-chloromethylpyrazoles **Ia–Ih** effected by sodium azide in DMSO solution giving new functional derivatives, 4-azido-methyl-pyrazoles **IIa–IIh** whose structure was confirmed by IR and ^{1}H NMR spectra. The reduction of compounds **IIa–IIh** with the use of Raney nickel in 2-propanol solution afforded 4-pyrazolyl-methylamines **IIIa–IIIh** in 75–90% yields.

By the second procedure (*b*) the target amines **IIIa–IIIh** were synthesized in about similar yields by Gabriel reaction [4]. To this end 4-chloromethylpyrazoles **Ia–Ih** were brought into reaction with potassium phthalimide, and the resulting *N*-(4-pyrazolyl)methylphthalimides **IVa–IVh** obtained in nearly quantitative yield were subjected to hydrazinolysis in ethanol (Scheme 1).

3-Aryl(heteryl)-1-phenyl-4-pyrazolylmethylamines **IIIa–IIIh** are low-melting crystalline substances whose composition was proved by elemental analysis, and the structure by ^{1}H NMR spectra. The specific feature of these spectra was appearance of a singlet in the region 3.83–3.88 ppm belonging to CH_2 group evidencing fast exchange of the protons of the NH_2 group that we failed to identify since their signal coincided with the resonance of water present in the DMSO-d_6 (2.8–3.1ppm). In the ^{1}H NMR spectra of amines **Va, Vb** hydrochlorides registered under similar conditions the protons of CH_2 and NH_3^+ groups appeared as multiplets whose centers were located respectively at 4.09(4.07) and 8.80(8.78) ppm indicating the absence or significant deceleration of NH protons exchange in these salts

From 4-pyrazolylmethylamines we prepared both previously unknown 4-isothiocyanato-methylpyrazoles and the compounds we had previously obtained from 4-chloromethylpyrazoles and sodium thiocyanate [5]. It is important that although in the recent 25–30 years the chemistry of organic isothiocyanates has been extensively developed [6] in the series of five-membered nitrogen-containing heterylmethyl isothiocyanates only few representatives of indolyl-3-methyl isocyanates [7], pyrazolidinyl-3-methyl isocyanates [8], and tetrazolyl-1-methyl isocyanates [9] have been synthesized.

As known, the main preparation method for isocyanates is reaction of amines and their salts with phosgene [10]. We showed that the conversion of amines **IIIa, IIIf–IIIh** into the corresponding 4-isocyanato-methylpyrazoles **VIa–VId** was successfully performed by applying instead of phosgene the commonly used

* For communication XIV see [1].

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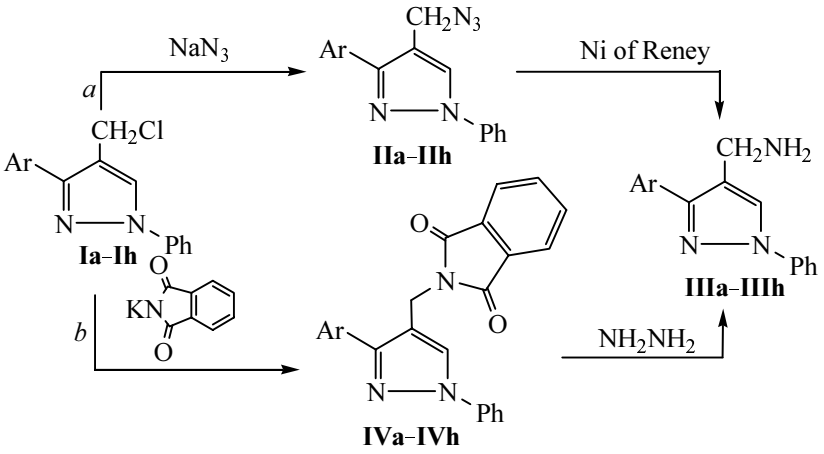
Scheme 1.



I–IV, Ar = Ph(**a**), 4-FC_6H_4(**b**), 4-ClC_6H_4(**c**), 3-BrC_6H_4(**d**), 4-BrC_6H_4(**e**), 4-MeC_6H_4(**f**), 4-$MeOC_6H_4$(**g**), 5-chloro-2-thienyl(**h**).

nowadays bis(trichloromethyl) carbonate (triphosgene) [11]. The resulting isocyanates **VIa** and **VIb** are viscous oily fluids distillable in a high vacuum. Compounds **VIc** and **VId** we failed to purify by distillation and identified them in urea **VIIa** and **VIIb** form.

4-Isothiocyanatomethylpyrazoles (**VIIIa–VIIIb**) were sinthesized form amines **IIIa, IIIb, IIIg** with the use of carbon disulfide [12], and they were isolated in a pure state that had not succeeded before [5].

EXPERIMENTAL

IR spectra of compounds were recorded on UR-20 instrument from KBr pellets. ^{1}H NMR spectra were registered on a spectrometer Varian-Gemini (300 MHz), internal reference TMS.

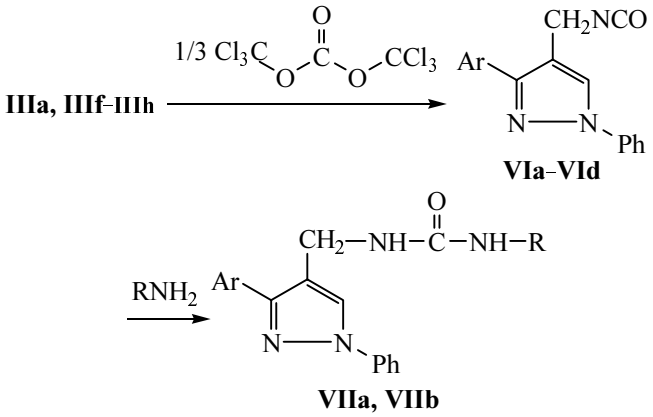
4-Azidomethyl-3-aryl(heteryl)-1-phenylpyrazoles IIa–IIh. A mixture of 10 mmol of 4-chloromethylpyrazole **Ia–Ih** and 1.3 g (20 mmol) of sodium azide in 20 ml of DMSO was heated for 3 h at 80°C, then cooled, and poured into 100 ml of water. The separated precipitate was filtered off, washed with water, with 50% aqueous ethanol, and dried. Compound **IIa.** Yield 73%, mp 82–84°C. IR spectrum, cm^{-1}: 2170 (N_3). ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 4.51 s (2H, CH_2), 7.33–7.49 m ($6H_{arom}$), 7.78–7.84 m ($4H_{arom}$), 8.64 s (1H, H^5). Found, %: C 69.50; H 4.86; N 25.63. $C_{16}H_{13}N_5$. Calculated, %: C 69.80; H 4.76; N 25.44.

Compound **IIb**. Yield 80%, mp 59–60°C. IR spectrum, cm^{-1}: 2170 (N_3). ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 4.50 s (2H, CH_2), 7.26–7.86 m ($9H_{arom}$), 8.66 s (1H, H^5). Found, %: C 65.27; H 4.15; N 23.99. $C_{16}H_{12}FN_5$. Calculated, %: C 65.52; H 4.12; N 23.88.

Compound **IIc**. Yield 70%, mp 87–89°C. IR spectrum, cm^{-1}: 2165 (N_3). ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 4.49 s (2H, CH_2), 7.31–7.51 m ($5H_{arom}$), 7.76 d ($2H_{arom}$, J 7.9 Hz), 7.86 d ($2H_{arom}$, J 7.8 Hz), 8.63 s (1H, H^5). Found, %: C 62.30; H 4.01; N 22.84. $C_{16}H_{12}ClN_5$. Calculated, %: C 62.04; H 3.90; N 22.61.

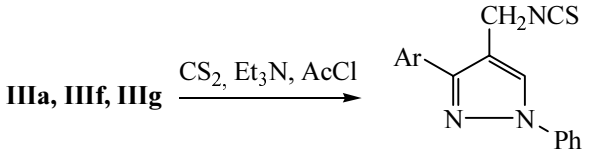
Compound **IId**. Yield 68%, mp 71–72°C. IR spectrum, cm^{-1}: 2170 (N_3). ^{1}H NMR spectrum (DMSO-d_6), δ,

Scheme 2.



VI, Ar = Ph(**a**), 4-MeC_6H_4(**b**), 4-$MeOC_6H_4$(c), 5-chloro-2-thienyl (**d**); **VII**, R = 4-ClC_6H_4, Ar = 4-$MeOC_6H_4$ (**a**), 5-chloro-2- thienyl (**b**). **VIII**, Ar = Ph(**a**), 4-MeC_6H_4(**b**), 4-$MeOC_6H_4$(**c**).

Scheme 3.



VIII, Ar = Ph(**a**), 4-MeC_6H_4 (**b**), 4-$MeOC_6H_4$ (**c**).

ppm: 4.48 s (2H, CH_2), 7.24–7.81 m ($9H_{arom}$), 8.65 s (1H, H^5). Found, %: C 54.00; H 3.49; N 19.90. $C_{16}H_{12}BrN_5$. Calculated, %: C 54.26; H 3.41; N 19.77.

Compound **IIe**. Yield 86%, mp 95–98°C. IR spectrum, cm^{-1}: 2175 (N_3). ^1H NMR spectrum (DMSO-d_6), δ, ppm: 4.49 s (2H, CH_2), 7.30 t ($1H_{arom}$, *J* 7.7 Hz), 7.49 t ($2H_{arom}$, *J* 7.9 Hz), 7.62 d ($2H_{arom}$, *J* 7.9 Hz), 7.70 d ($2H_{arom}$, *J* 7.8 Hz), 7.86 t ($2H_{arom}$, *J* 7.9 Hz), 8.62 s (1H, H^5). Found, %: C 54.02; H 3.53; N 19.89. $C_{16}H_{12}BrN_5$. Calculated, %: C 54.26; H 3.41; N 19.77.

Compound **IIf**. Yield 87%, mp 65–66°C. IR spectrum, cm^{-1}: 2165 (N_3). ^1H NMR spectrum (DMSO-d_6), δ, ppm: 2.37 s (3H, CH_3), 4.50 s (2H, CH_2), 7.22–7.30 m ($3H_{arom}$), 7.44 t ($2H_{arom}$, *J* 7.7 Hz), 7.64 d ($2H_{arom}$, *J* 7.8 Hz), 7.80 d ($2H_{arom}$, *J* 7.8 Hz), 8.67 s (1H, H^5). Found, %: C 70.27; H 5.13; N 24.00. $C_{17}H_{15}N_5$. Calculated, %: C 70.57; H 5.23; N 24.20.

Compound **IIg**. Yield 75%, mp 61–62°C. IR spectrum, cm^{-1}: 2170 (N_3). ^1H NMR spectrum (DMSO-d_6), δ, ppm: 3.88 s (3H, CH_3O), 4.48 s (2H, CH_2), 7.08 d ($2H_{arom}$, *J* 8.0 Hz), 7.25–7.30 m ($3H_{arom}$), 7.42 t ($2H_{arom}$, *J* 7.9 Hz), 7.80 d ($2H_{arom}$, *J* 8.0 Hz), 8.64 s (1H, H^5). Found, %: C 66.52; H 5.05; N 22.80. $C_{17}H_{15}N_5O$. Calculated, %: C 66.80; H 4.95; N 22.94.

Compound **IIh**. Yield 69%, mp 90–92°C. IR spectrum, cm^{-1}: 2170 (N_3). ^1H NMR spectrum (DMSO-d_6), δ, ppm: 4.48 s (2H, CH_2), 6.92 d ($1H_{arom}$, *J* 6.2 Hz), 7.28–7.73 m ($6H_{arom}$), 8.63 s (1H, H^5). Found, %: C 53.00; H 3.04; N 22.02. $C_{14}H_{10}ClN_5S$. Calculated, %: C 53.25; H 3.19; N 22.18.

***N*-[3-Aryl(heteryl)-1-phenyl-4-pyrazolylmethyl]-phthalimides IVa–IVh.** A mixture of 20 mmol of 4-chloromethylpyrazole **Ia–Ih** and 3.7 g (20 mmol) of potassium phthalimide in 15 ml of DMF was boiled for 3 h, and on cooling poured into 100 ml of water. The separated precipitate was filtered off, dried, and crystallized from a mixture dioxane–ethanol, 1:1.

Compound **IVa**. Yield 94%, mp 175–176°C. IR spectrum, cm^{-1}: 1680, 1700, 1755 (C=O). ^1H NMR spectrum (DMSO-d_6), δ, ppm: 4.86 s (2H, CH_2), 7.26 t ($1H_{arom}$, *J* 7.9 Hz), 7.54–7.82 m ($11H_{arom}$), 8.38 s (1H, H^5). Found, %: C 75.72; H 4.38; N 10.78. $C_{24}H_{17}N_3O_2$. Calculated, %: C 75.98; H 4.52; N 11.07.

Compound **IVb**. Yield 95%, mp 159–160°C. IR spectrum, cm^{-1}: 1685, 1700, 1750 (C=O). ^1H NMR spectrum (DMSO-d_6), δ, ppm: 4.85 s (2H, CH_2), 7.25 t ($3H_{arom}$, *J* 8.0 Hz), 7.43 t ($2H_{arom}$, *J* 7.9 Hz), 7.80–7.85 m ($8H_{arom}$), 8.38 s (1H, H^5). Found, %: C 72.45; H 4.18; N 10.29. $C_{24}H_{16}FN_3O_2$. Calculated, %: C 72.54; H 4.06; N 10.52.

Compound **IVs**. Yield 98%, mp 172–173°C. IR spectrum, cm^{-1}: 1680, 1705, 1755 (C=O). ^1H NMR spectrum (DMSO-d_6), δ, ppm: 4.88 s (2H, CH_2), 7.26 t ($1H_{arom}$, *J* 7.7 Hz), 7.44–7.53 m ($4H_{arom}$), 7.79–7.88 m ($8H_{arom}$), 8.36 s (1H, H^5). Found, %: C 69.34; H 3.83; N 10.24. $C_{24}H_{16}ClN_3O_2$. Calculated , %: C 69.65; H 3.90; N 10.15.

Compound **IVd**. Yield 96%, mp 206–207°C. IR spectrum, cm^{-1}: 1675, 1695, 1745 (C=O). ^1H NMR spectrum (DMSO-d_6), δ, ppm: 4.88 s (2H, CH_2), 7.27 t ($1H_{arom}$, *J* 7.7 Hz), 7.44–7.97 m ($12H_{arom}$), 8.42 s (1H, H^5). Found, %: C 62.64; H 3.78; N 9.28. $C_{24}H_{16}BrN_3O_2$. Calculated, %: C 62.90; H 3.52; N 9.17.

Compound **IVe**. Yield 89%, mp 187–188°C. IR spectrum, cm^{-1}: 1685, 1695, 1745 (C=O). ^1H NMR spectrum (DMSO-d_6), δ, ppm: 4.87 s (2H, CH_2), 7.26 t ($1H_{arom}$, *J* 7.8 Hz), 7.39–7.84 m ($12H_{arom}$), 8.40 s (1H, H^5). Found, %: C 63.27; H 3.29; N 9.44. $C_{24}H_{16}BrN_3O_2$. Calculated, %: C 62.90; H 3.52; N 9.17.

Compound **IVf**. Yield 90%, mp 174–175°C. IR spectrum, cm^{-1}: 1680, 1705, 1755 (C=O). ^1H NMR spectrum (DMSO-d_6), δ, ppm: 2.41 s (3H, CH_3), 4.87 C (2H, CH_2), 7.26–7.31 m ($3H_{arom}$), 7.43 t ($2H_{arom}$, *J* 7.7 Hz), 7.67 d ($2H_{arom}$, *J* 7.8 Hz), 7.81–7.94 m ($6H_{arom}$), 8.31 s (1H, H^5). Found, %: C 76.69; H 5.02; N 10.40. $C_{25}H_{19}N_3O_2$. Calculated, %: C 76.32; H 4.87; N 10.68.

Compound **IVg**. Yield 88%, mp 193–194°C. IR spectrum, cm^{-1}: 1680, 1700, 1750 (C=O). ^1H NMR spectrum (DMSO-d_6), δ, ppm: 3.84 s (3H, CH_3O), 4.87 C (2H, CH_2), 7.09 d ($2H_{arom}$, *J* 8.0 Hz), 7.25–7.30 m ($3H_{arom}$), 7.42 t ($2H_{arom}$, *J* 7.8 Hz), 7.80–7.96 m ($6H_{arom}$), 8.33 s (1H, H^5). Found, %: C 73.11; H 4.54; N 10.21. $C_{25}H_{19}N_3O_3$. Calculated, %: C 73.44; H 4.68; N 10.26.

Compound **IVh**. Yield 90%, mp 198–200°C. IR spectrum, cm^{-1}: 1675, 1700, 1745 (C=O). ^1H NMR spectrum (DMSO-d_6), δ, ppm: 4.85 s (2H, CH_2), 6.92 d ($1H_{arom}$, *J* 6.0 Hz), 7.27–7.50 m ($4H_{arom}$), 7.79–7.88 m ($6H_{arom}$), 8.38 s (1H, H^5). Found, %: C 63.25; H 3.20; N 10.18. $C_{22}H_{14}ClN_3O_2S$. Calculated, %: C 62.93; H 3.36; N 10.01.

3-Aryl(heteryl)-1-phenyl-4-pyrazolylmethylamines IIIa–IIIh. *a.* To a dispersion of Raney nickel prepared from 1 g of nickel-aluminum alloy [13] in 10 ml of 2-propanol was added 4 mmol of 4-azidomethylpyrazole **IIa–IIh**, and the mixture was heated for 1 h at 60°C. The nitrogen liberation observed ended within 0.5 h. On

cooling the precipitate was filtered off, the filtrate was evaporated to afford an oily residue that crystallized within 5–10 days.

b. To a boiling mixture of 13mmol of compound **IVa–IVh** and 1.5 g of 60% hydrazine hydrate was added within 2 h 40 ml of water, then 10 ml of HCl, and the heating was continued for 2 h more. The mixture obtained was filtered while hot. On cooling to the filtrate was added 30 ml of 20% NaOH solution, the organic layer was extracted with 60 ml of benzene and dried over anhydrous sodium sulfate. On evaporating the solvent an oily residue was obtained that crystallized within 5–10 days.

Compound IIIa. Yield 88% (*a*), 85% (*b*), mp 52–54°C. ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 3.85 s (2H, CH_2), 7.28–7.46 m ($6H_{arom}$), 7.80–7.85 m ($4H_{arom}$), 8.44 s (1H, H^5). Found, %: C 76.85; H 6.25; N 16.67. $C_{16}H_{15}N_3$. Calculated, %: C 77.08; H 6.06; N 16.89.

Compound IIIb. Yield 85% (*a*), 87% (*b*), mp 57–59°C. ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 3.83 s (2H, CH_2), 7.19–7.27 m ($3H_{arom}$), 7.49 t ($2H_{arom}$, *J* 8.0 Hz), 7.80–7.88 m ($4H_{arom}$), 8.44 s (1H, H^5). Found, %: C 72.15; H 5.20; N 15.94. $C_{16}H_{14}FN_3$. Calculated, %: C 71.89; H 5.28; N 15.72.

Compound IIIc. Yield 90% (*a*), 89% (*b*), mp 62–64°C. ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 3.87 s (2H, CH_2), 7.27 t ($1H_{arom}$, *J* 7.7 Hz), 7.42–7.49 m ($4H_{arom}$), 7.83–7.88 m ($4H_{arom}$), 8.36 s (1H, H^5). Found, %: C 76.49; H 5.14; N 14.82. $C_{16}H_{14}ClN_3$. Calculated, %: C 76.72; H 4.97; N 14.81.

Compound IIId. Yield 84% (*a*), 91% (*b*), mp 86–89°C. ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 3.86 s (2H, CH_2), 7.27–7.86 m ($9H_{arom}$), 8.37 s (1H, H^5). Found, %: C 58.20; H 4.51; N 11.93. $C_{16}H_{14}BrN_3$. Calculated, %: C 58.55; H 4.30; N 12.18.

Compound IIIe. Yield 83% (*a*), 82% (*b*), mp 93–94°C. ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 3.85 s (2H, CH_2), 7.27 t ($1H_{arom}$, *J* 7.7 Hz), 7.48–7.89 m ($8H_{arom}$), 8.40 s (1H, H^5). Found, %: C 58.31; H 4.44; N 12.25. $C_{16}H_{14}BrN_3$. Calculated, %: C 58.55; H 4.30; N 12.18.

Compound IIIf. Yield 78% (*a*), 80% (*b*), mp 80–82°C. ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 2.39 s (3H, CH_3), 3.88 s (2H, CH_2), 7.25–7.31 m ($3H_{arom}$), 7.47 t ($2H_{arom}$, *J* 7.7 Hz), 7.69 d ($2H_{arom}$, *J* 7.8 Hz), 7.83 d ($2H_{arom}$, *J* 7.8 Hz), 8.35 s (1H, H^5). Found, %: C 77.29; H 6.36; N 16.22. $C_{17}H_{17}N_3$. Calculated, %: C 77.54; H 6.51; N 15.96.

Compound IIIg. Yield 75% (*a*), 79% (*b*), mp 78–80°C. ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 3.82 s (3H, CH_3O), 3.88 s (2H, CH_2), 7.14 d ($2H_{arom}$, *J* 8.0 Hz), 7.23–7.28 m ($3H_{arom}$), 7.44 t ($2H_{arom}$, *J* 7.8 Hz), 7.82 d ($2H_{arom}$, *J* 8.0 Hz), 8.37 s (1H, H^5). Found, %: C 72.95; H 6.01; N 15.25. $C_{17}H_{17}N_3O$. Calculated, %: C 73.10; H 6.13; N 15.04.

Compound **IIIh.** Yield 82% (*a*), 75% (*b*), mp 52–54°C. ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 3.86 s (2H, CH_2), 6.94 d ($1H_{arom}$, *J* 6.3 Hz), 7.25–7.73 m ($4H_{arom}$), 7.75 d ($2H_{arom}$, *J* 7.8 Hz), 8.25 s (1H, H^5). Found, %: C 57.80; H 4.05; N 14.65. $C_{14}H_{12}ClN_3S$. Calculated, %: C 58.03; H 4.17; N 14.50.

3-Aryl(heteryl)-1-phenyl-4-pyrazolylmethylamines hydrochlorides Va and Vb. To 2 mmol of amine **IIIa** and **IIIb** was added 3 ml of concn. HCl, in 1 h 5 ml of water was added, the precipitate was filtered off and dried in air.

1,3-Diphenyl-4-pyrazolylmethylamine hydrochloride (Va). Yield 88%, mp 234–237°C. ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 4.09 m (2H, CH_2), 7.32–7.83 m ($10H_{arom}$), 8.80 m (3H, NH_3^+), 8.89 s (1H, H^5). Found, %: C 67.65; H 5.32; N 14.39. $C_{16}H_{16}ClN_3$. Calculated, %: C 67.75; H 5.64; N 14.70.

1-Phenyl-3-(4-fluorophenyl)-4-pyrazolylmethylamine hydrochloride (Vb). Yield 95%, mp 242–244°C. ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 4.07 m (2H, CH_2), 7.23–7.31 m ($3H_{arom}$), 7.50 t ($2H_{arom}$), 7.73–7.82 m ($4H_{arom}$), 8.78 m (3H, NH_3^+), 8.88 s (1H, H^5). Found, %: C 62.82; H 5.29; N 14.12. $C_{16}H_{15}FClN_3$. Calculated, %: C 63.26; H 4.98; N 13.83.

3-Aryl(heteryl)-4-isocyanatopyrazoles VIa–VId and *N*-[3-aryl(heteryl)-1-phenyl-4-pyrazolylmethyl]-ureas VIIa and **VIIb.** To a solution of 0.4 g (1.33 mmol) of triphosgene in 30 ml of toluene (with amines **IIIa, IIIf, IIIg**) or xylene (with amine **IIIh**) at 0°C while stirring was added dropwise a mixture of 4 mmol of amine **IIIa, IIIf–IIIh** and 0.8 g (8 mmol) of triethylamine in 15 ml of an appropriate solvent. The reaction mixture was stirred at constant temperature for 1 h, and then it was heated at reflux for a required period: amine **IIIa**, 5 h; **IIIf**, 6 h; amine **IIIg**, 12 h; and amine **IIIh**, 12 h. The reaction mixture was cooled to room temperature, the precipitate of triethylamine hydrochloride was filtered off, the filtrate was evaporated, and the residue was either distilled in a vacuum (for compounds **VIa** and **VIb**) or dissolved in 5 ml of acetonitrile (for compounds **VIc, VId**), to the solution 0.51g (4 mmol) of *p*-chloroaniline was added, and the mixture was left standing for 24 h. The formed precipitate of compounds **VIIa** and **VIIb** was filtered off and crystallized from a mixture ethanol–dioxane, 1:3.

4-IsocyanatOmethyl-1,3-diphenylpyrazole (VIa). Yield 55%, bp 130–133°C (0.03 mm Hg). IR spectrum (CH_2Cl_2), cm^{-1}: 2250 (NCO). ^1H NMR spectrum ($CDCl_3$), δ, ppm: 4.59 s (2H, CH_2), 7.32–7.53 m ($6H_{arom}$), 7.73–7.80 m ($4H_{arom}$), 8.03 s (1H, H^5). Found, %: C 73.74; H 4.99; N 15.02. $C_{17}H_{13}N_3O$. Calculated, %: C 74.16; H 4.76; N 15.26.

4-IsocyanatOmethyl-3-(4-tolyl)-1-phenylpyrazole (VIb). Yield 52%, bp 180–184°C (0.03 mm Hg). IR spectrum (CH_2Cl_2), cm^{-1}: 2250 (NCO). ^1H NMR spectrum ($CDCl_3$), δ, ppm: 2.42 s (3H, CH_3), 4.57 m (2H, CH_2), 7.26–7.31 m ($3H_{arom}$), 7.47 t ($2H_{arom}$, *J* 7.9 Hz), 7.60 d ($2H_{arom}$, *J* 7.9 Hz), 7.74 d ($2H_{arom}$, *J* 7.9 Hz), 8.01 s (1H, H^5). Found, %: C 75.13; H 5.47; N 14.20. $C_{18}H_{15}N_3O$. Calculated, %: C 74.72; H 5.23; N 14.52.

***N*-[3-(4-Methoxyphenyl)-1-phenyl-4-pyrazolylmethyl]-*N*'-(4-chlorophenyl)urea (VIIa).** Yield 58%, mp 246–248°C. ^1H NMR spectrum (DMSO-d_6), δ, ppm: 3.82 s (3H, CH_3O), 4.36 d (2H, CH_2, *J* 3.4 Hz), 6.44 t (1H, NH, *J* 3.4 Hz), 6.98 d ($2H_{arom}$, *J* 7.8 Hz), 7.16–7.52 m ($7H_{arom}$), 7.71 d ($2H_{arom}$, *J* 7.8 Hz), 7.85 d ($2H_{arom}$, *J* 7.8 Hz), 8.36 s (1H, H^5), 8.46 s (1H, NH). Found, %: C 66.17; H 5.07; N 13.13. $C_{24}H_{21}ClN_4O_2$. Calculated, %: C 66.59; H 4.89; N 12.94.

***N*-[3-(5-Chlorothienyl-2)-1-phenyl-4-pyrazolylmethyl]-N'-(4-chlorophenyl)urea (VIIb).** Yield 63%, mp 243–245°C. ^1H NMR spectrum (DMSO-d_6), δ, ppm: 4.41 d (2H, CH_2, *J* 3.5 Hz), 6.51 t (1H, NH, *J* 3.5 Hz), 7.08–7.52 m ($8H_{arom}$), 7.82 d ($2H_{arom}$, *J* 7.7 Hz), 8.42 s (1H, H^5), 8.52 s (1H, NH). Found, %: C 56.47; H 3.57; N 12.93. $C_{21}H_{16}Cl_2N_4OS$. Calculated, %: C 56.89; H 3.64; N 12.64.

3-Aryl(heteryl)-4-isothiocyanatopyrazoles VIIIa–VIIIc. To a mixture of 4 mmol of amine **IIIa**, **IIIf**, or **IIIg** and 0.41g (4 mmol) of triethylamine in 10 ml of chloroform was added dropwise 0.31g (4 mmol) of carbon disulfide maintaining the reaction temperature below 35°C. Then in succession was added dropwise 0.41g (4 mmol) of triethylamine and 0.32 g (4 mmol) of acetyl chloride maintaining the same temperature. The reaction mixture was stirred for 4 h and poured into 50 ml of water, the organic layer was separated, dried with K_2CO_3, the solvent was evaporated, to the oily residue 15 ml of hexane was added, and it was kept in a refrigerator for 5–7 days. The solidified substance was recrystallized from a mixture benzene–hexane, 3:1.

4-Isothiocyanatomethyl-1,3-diphenylpyrazole (VIIIa). Yield 50%, mp 95–97°C. IR spectrum (CH_2Cl_2), cm^{-1}: 2060 (NCS). ^1H NMR spectrum ($CDCl_3$), δ, ppm: 4.78 s (2H, CH_2), 7.30–7.52 m ($6H_{arom}$), 7.62–7.75 m ($4H_{arom}$), 8.07 s (1H, H^5). Found, %: C 70.44; H 4.47; N 14.63. $C_{17}H_{13}N_3S$. Calculated, %: C 70.08; H 4.50; N 14.42.

4-Isothiocyanatomethyl-3-(4-tolyl)-1-phenylpyrazole (VIIIb). Yield 44%, mp 99–100°C. IR spectrum (CH_2Cl_2), cm^{-1}: 2065 (NCS). ^1H NMR spectrum ($CDCl_3$), δ, ppm: 2.40 s (3H, CH_3), 4.82 m (2H, CH_2), 7.18–7.29 m ($3H_{arom}$), 7.40 t ($2H_{arom}$, *J* 7.8 Hz), 7.66 d ($2H_{arom}$, *J* 7.8 Hz), 7.78 d ($2H_{arom}$, *J* 7.8 Hz), 8.10 s (1H, H^5). Found, %: C 71.27; H 4.63; N 14.05. $C_{18}H_{15}N_3S$. Calculated, %: C 70.79; H 4.95; N 13.76.

4-Isothiocyanatomethyl-3-(4-methoxyphenyl)-1-phenylpyrazole (VIIIc). Yield 47%, mp 83–86°C. IR spectrum (CH_2Cl_2), cm^{-1}: 2060 (NCS). ^1H NMR spectrum ($CDCl_3$), δ, ppm: 3.86 s (3H, CH_3O), 4.80 m (2H, CH_2), 6.97 d ($2H_{arom}$, *J* 8.0 Hz), 7.26–7.45 m ($3H_{arom}$), 7.62 d ($2H_{arom}$, *J* 8.0 Hz), 7.73 d ($2H_{arom}$, *J* 7.9 Hz), 8.13 s (1H, H^5). Found, %: C 67.01; H 4.85; N 12.75. $C_{18}H_{15}N_3OS$. Calculated, %: C 67.27; H 4.70; N 13.07.

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