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SHORT COMMUNICATIONS

Alkylation and Aminomethylation of New 4,5-Substituted 4*H*-1,2,4-Triazole-3-thiols

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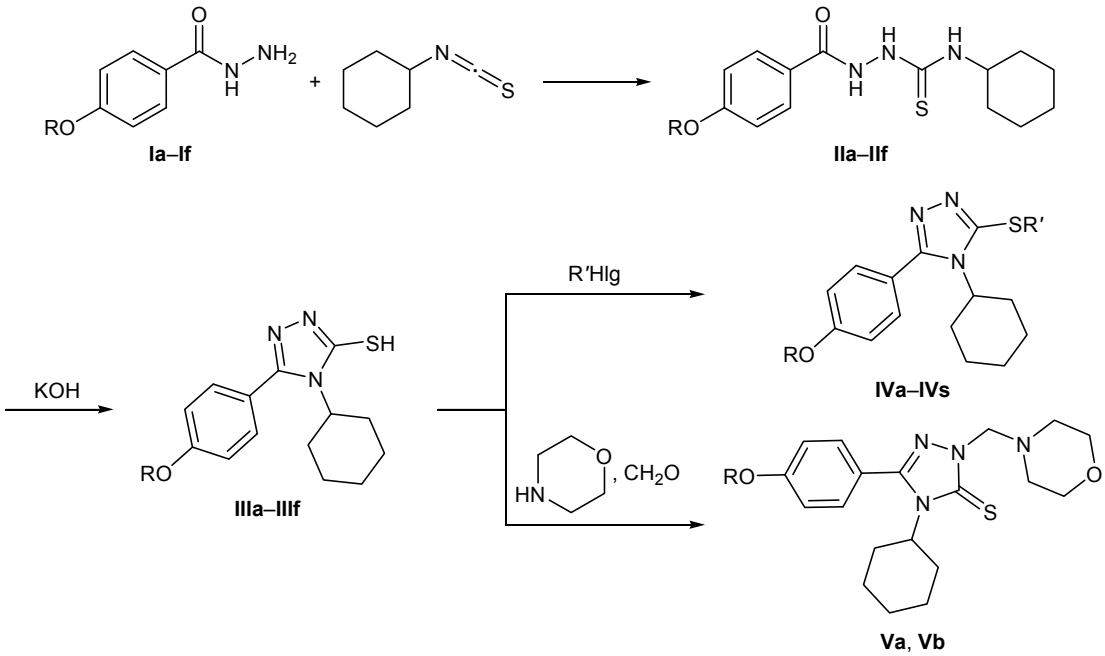
We previously synthesized 5-[alkoxyphenyl(alkoxyphenethyl, benzofuryl)]-4-phenyl(allyl)-4*H*-1,2,4-triazole-3-thiols some of which (specifically *N*- and *S*-substituted derivatives) were found to exhibit antitumor activity [1]. While continuing studies in this line, we tried to find new efficient compounds among substituted 1,2,4-triazole-3-thiols and reveal a possible relation between their chemical structure and antitumor activity. For this purpose, we have synthesized new 1,2,4-triazole-3-thiol derivatives containing a cyclohexyl substituent on C^4.

1,4-Substituted thiosemicarbazides **IIa**–**IIf** were synthesized by heating the corresponding 4-alkoxybenzohydrazides with cyclohexyl isothiocyanate. The cyclization of thiosemicarbazides **IIa**–**IIf** in 4.5% aqueous potassium hydroxide gave 5-alkoxyphenyl-4-cyclohexyl-4*H*-1,2,4-triazole-3-thiols **IIIa**–**IIIf** which were subjected to S-alkylation with α-halo carboxylic



I–**III**, R = Me (**a**), Et (**b**), Pr (**c**), *i*-Pr (**d**), Bu (**e**), *i*-Bu (**f**); **IV**, R = Me, R′ = CH_2COOH (**a**), CH(Me)COOH (**b**), CH(Bu)COOH (**c**); R = Et, R′ = CH_2COOH (**d**), CH(Me)COOH (**e**); R = Pr, R′ = CH_2COOH (**f**), CH(Me)COOH (**g**); R = *i*-Pr, R′ = CH_2COOH (**h**), CH(Me)COOH (**i**); R = Bu, R′ = CH_2COOH (**j**), CH(Me)COOH (**k**); R = *i*-Bu, R′ = CH_2COOH (**l**), CH(Me)COOH (**m**); R′ = CH_2CH_2OH, R = Me (**n**), Et (**o**), Pr (**p**), *i*-Pr (**q**), Bu (**r**), *i*-Bu (**s**); **V**, R = Me (**a**), Et (**b**).

acids in water in the presence of 3 equiv of KOH, as well as with 2-chloroethanol in alcohol in the presence of 1 eqiv of KOH.

Like other cyclic thioamides, triazole-3-thiols **IIIa** and **IIIb** reacted as thione tautomers [2] with morpholine and formaldehyde in ethanol according to Mannich to afford 2-(morpholin-4-ylmethyl)-2,4-dihydro-3*H*-1,2,4-triazole-3-thiones **Va** and **Vb**. The structure of the newly synthesized compounds was confirmed by their elemental compositions and ^{1}H NMR spectra.

5-(4-Alkoxyphenyl)-4-cyclohexyl-4*H*-1,2,4-triazole-3-thiols IIIa–IIIf (*genearl procedure*). A solution of 10 mmol of thiosemicarbazide **IIa–IIf** and 1 g of potassium hydroxide in 50 ml of water was heated for 2 h under reflux. The mixture was cooled and treated with acetic acid to pH 5, and the precipitate was filtered off, washed with water, dried, and recrystallized from 70% ethanol.

4-Cyclohexyl-5-(4-methoxyphenyl)-4*H*-1,2,4-triazole-3-thiol (IIIa). Yield 93%, mp 185–186°C, R_f 0.60. ^{1}H NMR spectrum, δ, ppm: 1.11–1.30 m (1H), 1.61 m (2H), 1.76 m (4H), and 2.19 m (2H) (C_6H_{11}); 3.87 s (3H, OCH_3), 4.31 m (1H, NCH), 7.01 m and 7.37 m (2H each, C_6H_4), 13.57 br (1H, SH). Found, %: N 14.31; S 11.25. $C_{15}H_{19}N_3OS$. Calculated, %: N 14.52; S 11.07.

4-Cyclohexyl-5-(4-ethoxyphenyl)-4*H*-1,2,4-triazole-3-thiol (IIIb). Yield 98%, mp 223–224°C, R_f 0.62. ^{1}H NMR spectrum, δ, ppm: 1.10 m (1H), 1.20–1.38 m (2H), 1.61 m (1H), 1.67–1.85 m (4H), and 2.19 m (2H) (C_6H_{11}); 1.45 t (3H, CH_3, J = 7.0 Hz), 4.11 q (2H, OCH_2, J = 7.0 Hz), 4.31 m (1H, NCH), 6.95 m and 7.35 m (2H each, C_6H_4), 13.55 br (1H, SH). Found, %: N 13.65; S 10.37. $C_{16}H_{21}N_3OS$. Calculated, %: N 13.84; S 10.56.

4-Cyclohexyl-5-(4-propoxyphenyl)-4*H*-1,2,4-triazole-3-thiol (IIIc). Yield 92%, mp 205–206°C, R_f 0.61. ^{1}H NMR spectrum, δ, ppm: 1.06 t (3H, CH_3, J = 7.4 Hz); 1.16–1.36 m (3H), 1.65 m (1H), 1.77–1.90 m (4H), and 2.03–2.18 m (2H) (C_6H_{11}); 1.85 m (2H, C**H**$_2$CH$_3$), 4.05 m (1H, NCH), 4.08 t (2H, OCH_2, J = 6.4 Hz), 7.00 m and 7.40 m (2H each, C_6H_4), 13.36 br.s (1H, SH). Found, %: N 13.45; S 10.26. $C_{17}H_{23}N_3OS$. Calculated, %: N 13.23; S 10.10.

4-Cyclohexyl-5-(4-isopropoxyphenyl)-4*H*-1,2,4-triazole-3-thiol (IIId). Yield 98%, mp 196–197°C, R_f 0.63. ^{1}H NMR spectrum, δ, ppm: 1.10–1.34 m (3H), 1.67 m (1H), 1.76–1.90 m (4H), and 2.00–2.17 m (2H) (C_6H_{11}); 1.37 d [6H, CH(C**H**$_3$)$_2$, J = 6.0 Hz], 4.02 m (1H, NCH), 4.64 sept [1H, C**H**(CH$_3$)$_2$, J = 6.0 Hz], 6.97 m and 7.35 m (2H each, C_6H_4), 13.42 br.s (1H, SH). Found, %: N 13.32; S 10.28. $C_{17}H_{23}N_3OS$. Calculated, %: N 13.23; S 10.10.

5-(4-Butoxyphenyl)-4-cyclohexyl-4*H*-1,2,4-triazole-3-thiol (IIIe). Yield 91%, mp 165–166°C, R_f 0.67. ^{1}H NMR spectrum, δ, ppm: 1.01 t (3H, CH_3, J = 7.4 Hz); 1.11 m (1H), 1.21–1.38 m (2H), 1.61 m (1H), 1.68–1.84 m (4H), and 2.20 m (2H) (C_6H_{11}); 1.53 m (2H, C**H**$_2$CH$_3$), 1.79 m (2H, OCH$_2$C**H**$_2$), 4.03 t (2H, OCH_2, J = 6.4 Hz), 4.31 m (1H, NCH), 6.98 m and 7.34 m (2H each, C_6H_4), 13.50 br (1H, SH). Found, %: N 12.45; S 9.38. $C_{18}H_{25}N_3OS$. Calculated, %: N 12.67; S 9.67.

4-Cyclohexyl-5-(4-isobutoxyphenyl)-4*H*-1,2,4-triazole-3-thiol (IIIf). Yield 93%, mp 185–186°C, R_f 0.60. ^{1}H NMR spectrum, δ, ppm: 1.07 d [6H, CH(C**H**$_3$)$_2$, J = 6.7 Hz]; 1.16–1.36 m (3H), 1.66 m (1H), 1.77–1.92 m (4H), and 2.09 m (2H) (C_6H_{11}); 2.12 sept [1H, C**H**(CH$_3$)$_2$, J 6.7 Hz], 3.81 d (2H, OCH_2, J = 6.4 Hz), 4.31 m (1H, NCH), 7.00 m and 7.36 m (2H each, C_6H_4), 13.21 br (1H, SH). Found, %: N 12.78; S 9.82. $C_{18}H_{25}N_3OS$. Calculated, %: N 12.67; S 9.67.

Substituted α-(4*H*-1,2,4-triazol-3-ylsulfanyl)-acetic, -propionic, and -hexanoic acids IVa–IVm (*general procedure*). A mixture of 6 mmol of potassium hydroxide, 30 ml of water, 2 mmol of triazole-3-thiol **IIIa–IIIf**, and 2 mmol of chloroacetic, 2-bromopropionic, or 2-bromohexanoic acid was heated for 2 h under reflux. The solution was filtered, the filtrate was adjusted to pH 5 by adding acetic acid, and the precipitate was filtered off, washed with water, dried, and recrystallized from ethanol.

[4-Cyclohexyl-5-(4-methoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]acetic acid (IVa). Yield 83%, mp 212–213°C, R_f 0.58. ^{1}H NMR spectrum, δ, ppm: 1.17–1.37 m (3H), 1.67 m (1H), 1.80–1.93 m (4H), and 2.11 m (2H) (C_6H_{11}); 3.87 s (3H, OCH_3), 3.99 m (1H, NCH), 4.05 s (2H, SCH_2), 7.02 m and 7.35 m (2H each, C_6H_4), 12.3 br.s (1H, COOH). Found, %: N 12.25; S 9.44. $C_{17}H_{23}N_2O_3S$. Calculated, %: N 12.09; S 9.61.

2-[4-Cyclohexyl-5-(4-methoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]propanoic acid (IVb). Yield 83%, mp 174–175°C, R_f 0.53. ^{1}H NMR spectrum, δ, ppm: 1.15–1.36 m (3H), 1.66 m (1H), 1.78–1.91 m (4H), and 2.00–2.16 m (2H) (C_6H_{11}); 1.65 d (3H, CH_3, J = 7.2 Hz), 3.87 s (3H, OCH_3), 4.00 m (1H, NCH), 4.44 q (1H, C**H**CH$_3$, J = 7.2 Hz), 7.02 m and 7.38 m

(2H each, C_6H_4), 12.6 br.s (1H, COOH). Found, %: N 11.45; S 8.96. $C_{18}H_{23}N_3O_3S$. Calculated, %: N 11.62; S 8.87.

2-[4-Cyclohexyl-5-(4-methoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]hexanoic acid (IVc). Yield 92%, mp 144–145°C, R_f 0.60. ^{1}H NMR spectrum, δ, ppm: 0.96 t (3H, CH_2CH_3, J = 7.1 Hz); 1.16–1.37 m (3H), 1.66 m (1H), 1.78–1.93 m (4H), and 1.99–2.17 m (2H) (C_6H_{11}); 1.37–1.55 m (4H, $CH_2CH_2CH_3$), 1.97 m (2H, $CHCH_2$), 3.88 s (3H, OCH_3), 4.00 m (1H, NCH), 4.37 t (1H, $SCHCH_2$, J = 6.9 Hz), 7.02 m and 7.37 m (2H each, C_6H_4), 11.4 br.s (1H, COOH). Found, %: N 10.18; S 8.14. $C_{21}H_{29}N_3O_3S$. Calculated, %: N 10.41; S 7.94.

[4-Cyclohexyl-5-(4-ethoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]acetic acid (IVd). Yield 98%, mp 187–188°C, R_f 0.57. ^{1}H NMR spectrum, δ, ppm: 1.17–1.37 m (3H), 1.68 m (1H), 1.81–1.93 m (4H), and 2.04–2.70 m (2H) (C_6H_{11}); 1.45 t (3H, CH_2CH_3, J = 7.0 Hz), 3.99 m (1H, NCH), 4.05 s (2H, SCH_2), 4.11 q (2H, OCH_2, J = 7.0 Hz), 6.99 m and 7.36 m (2H each, C_6H_4), 12.66 br.s (1H, COOH). Found, %: N 11.75; S 8.99. $C_{18}H_{23}N_3O_3S$. Calculated, %: N 11.65; S 8.87.

2-[4-Cyclohexyl-5-(4-ethoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]propionic acid (IVe). Yield 90%, mp 168–169°C, R_f 0.58. ^{1}H NMR spectrum, δ, ppm: 1.15–1.36 m (3H), 1.66 m (1H), 1.76–1.91 m (4H), and 2.00–2.16 m (2H) (C_6H_{11}); 1.45 t (3H, CH_2CH_3, J = 7.0 Hz), 1.65 d (3H, $CHCH_3$, J = 7.2 Hz), 4.00 m (1H, NCH), 4.11 q (2H, OCH_2, J = 7.0 Hz), 4.43 q (1H, $SCHCH_3$, J = 7.2 Hz), 6.99 m and 7.36 m (2H each, C_6H_4), 12.6 br.s (1H, COOH). Found, %: N 11.35; S 8.34. $C_{19}H_{25}N_3O_3S$. Calculated, %: N 11.19; S 8.53.

[4-Cyclohexyl-5-(4-propoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]acetic acid (IVf). Yield 80%, mp 175–176°C, R_f 0.54. ^{1}H NMR spectrum, δ, ppm: 1.08 t (3H, CH_2CH_3, J = 7.4 Hz); 1.17–1.37 m (3H), 1.67 m (1H), 1.80–1.92 m (4H), and 2.04–2.20 m (2H) (C_6H_{11}); 1.84 m (2H, CH_2CH_3), 3.99 m (1H, NCH), 4.00 t (2H, OCH_2, J = 6.4 Hz), 12.1 br.s (1H, COOH). Found, %: N 11.42; S 8.65. $C_{19}H_{25}N_3O_3S$. Calculated, %: N 11.19; S 8.53.

2-[4-Cyclohexyl-5-(4-propoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]propanoic acid (IVg). Yield 90%, mp 135–136°C, R_f 0.69. ^{1}H NMR spectrum, δ, ppm: 1.08 t (3H, CH_2CH_3, J = 7.4 Hz); 1.16–1.36 m (3H), 1.66 m (1H), 1.78–1.91 m (4H), and 2.00–2.17 m (2H) (C_6H_{11}); 1.65 d (3H, $SCHCH_3$, J = 7.2 Hz), 1.84 m (2H, CH_2CH_3), 4.00 m (1H, NCH), 4.00 t (2H, OCH_2, J = 6.4 Hz), 4.44 q (1H, $SCHCH_3$, J = 7.2 Hz), 7.00 m and 7.36 m (2H each, C_6H_4), 12.57 br.s (1H, COOH). Found, %: N 10.92; S 8.45. $C_{20}H_{27}N_3O_3S$. Calculated, %: N 10.78; S 8.23.

[4-Cyclohexyl-5-(4-isopropoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]acetic acid (IVh). Yield 98%, mp 193–194°C, R_f 0.55. ^{1}H NMR spectrum, δ, ppm: 1.17–1.35 m (3H), 1.67 m (1H), 1.87 m (4H), and 2.13 m (2H) (C_6H_{11}); 1.38 d [6H, $CH(CH_3)_2$, J = 6.0 Hz], 4.00 m (1H, NCH), 4.05 s (2H, SCH_2), 4.67 sept [1H, $CH(CH_3)_2$, J = 6.0 Hz], 6.97 m and 7.35 m (2H each, C_6H_4), 12.53 br.s (1H, COOH). Found, %: N 11.28; S 8.65. $C_{19}H_{25}N_3O_3S$. Calculated, %: N 11.19; S 8.53.

[4-Cyclohexyl-5-(4-isopropoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]propanoic acid (IVi). Yield 87%, mp 118–119°C, R_f 0.50. ^{1}H NMR spectrum, δ, ppm: 1.17–1.33 m (3H), 1.67 m (1H), 1.78–1.92 m (4H), and 2.02–2.18 m (2H) (C_6H_{11}); 1.38 d [6H, $CH(CH_3)_2$, J = 6.0 Hz], 1.65 d (3H, $SCHCH_3$, J = 7.2 Hz), 4.01 m (1H, NCH), 4.44 q (1H, $SCHCH_3$, J = 7.2 Hz), 4.66 m [1H, $CH(CH_3)_2$, J = 6.0 Hz], 6.97 m and 7.34 m (2H each, C_6H_4), 12.5 br.s (1H, COOH). Found, %: N 10.99; S 8.52. $C_{20}H_{27}N_3O_3S$. Calculated, %: N 10.78; S 8.23.

[5-(4-Butoxyphenyl)-4-cyclohexyl-4*H*-1,2,4-triazol-3-ylsulfanyl]acetic acid (IVj). Yield 87%, mp 136–137°C, R_f 0.57. ^{1}H NMR spectrum, δ, ppm: 1.02 t (3H, CH_2CH_3, J = 7.4 Hz); 1.16–1.37 m (3H), 1.67 m (1H), 1.75–1.92 m (4H), and 2.04–2.21 m (2H) (C_6H_{11}); 1.53 m (2H, CH_2CH_3), 1.80 m (2H, OCH_2CH_2), 3.95 m (1H, NCH), 4.04 t (2H, OCH_2, J = 6.4 Hz), 4.04 s (2H, SCH_2), 5.90 br (1H, COOH), 6.98 m and 7.36 m (2H each, C_6H_4). Found, %: N 10.52; S 8.46. $C_{20}H_{27}N_3O_3S$. Calculated, %: N 10.78; S 8.23.

2-[5-(4-Butoxyphenyl)-4-cyclohexyl-4*H*-1,2,4-triazol-3-ylsulfanyl]propanoic acid (IVk). Yield 77%, mp 147–148°C, R_f 0.57. ^{1}H NMR spectrum, δ, ppm: 1.04 t (3H, CH_2CH_3, J = 7.4 Hz); 1.14–1.36 m (3H), 1.67 m (1H), 1.74–1.91 m (4H), and 2.02–2.21 m (2H) (C_6H_{11}); 1.65 d (3H, $SCHCH_3$, J = 7.2 Hz), 1.51 m (2H, CH_2CH_3), 1.80 m (2H, OCH_2CH_2), 3.98 m (1H, NCH), 4.05 t (2H, OCH_2, J = 6.4 Hz), 4.43 q (1H, $SCHCH_3$), 6.98 m and 7.39 m (2H each, C_6H_4); the COOH signal was strongly broadened. Found, %: N 10.64; S 8.15. $C_{21}H_{29}N_3O_3S$. Calculated, %: N 10.41; S 7.94.

[4-Cyclohexyl-5-(4-isobutoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]acetic acid (IVl). Yield 80%, mp 145–146°C, R_f 0.55. ^{1}H NMR spectrum, δ, ppm: 1.06 t [6H, CH(C**H**$_3$)$_2$, J = 6.7 Hz]; 1.17–1.36 m (3H), 1.67 m (1H), 1.79–1.93 m (4H), and 2.10 m (2H) (C_6H_{11}); 2.14 sept [1H, C**H**(CH$_3$)$_2$, J = 6.7 Hz], 3.80 d (2H, OCH$_2$, J = 6.4 Hz); 3.99 m (1H, NCH), 4.04 s (2H, SCH$_2$), 7.00 m and 7.36 m (2H each, C_6H_4); the COOH signal was strongly broadened. Found, %: N 10.55; S 8.30. $C_{20}H_{27}N_3O_3S$. Calculated, %: N 10.78; S 8.23.

2-[4-Cyclohexyl-5-(4-isobutoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]propanoic acid (IVm). Yield 87%, mp 97–98°C, R_f 0.58. ^{1}H NMR spectrum, δ, ppm: 1.07 t [6H, CH(C**H**$_3$)$_2$, J = 6.7 Hz]; 1.16–1.36 m (3H), 1.66 m (1H), 1.77–1.92 m (4H), and 2.09 m (2H) (C_6H_{11}); 1.65 d (3H, SCHC**H**$_3$, J = 7.2 Hz), 12.12 sept [1H, C**H**(CH$_3$)$_2$, J = 6.7 Hz], 3.81 d (2H, OCH$_2$, J = 6.4 Hz), 4.00 m (1H, NCH), 4.44 q (1H, SC**H**CH$_3$, J = 7.2 Hz), 7.00 m and 7.36 m (2H each, C_6H_4); the COOH signal was strongly broadened. Found, %: N 10.45; S 7.85. $C_{21}H_{29}N_3O_3S$. Calculated, %: N 10.41; S 7.94.

Substituted 2-(4*H*-1,2,4-triazol-3-ylsulfanyl)-ethanols IVn–IVs (*general procedure*). 2-Chloroethanol, 10 mmol, was added to a solution of 1.0 mmol of potassium hydroxide and 10 mmol of triazole-3-thiol **IIIa**–**IIIf** in 20 ml of ethanol, and the mixture was heated for 45–60 min under reflux. The mixture was cooled, diluted with water, and left overnight, and the precipitate was filtered off, dried, and recrystallized from 70% ethanol.

2-[4-Cyclohexyl-5-(4-methoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]ethanol (IVn). Yield 60%, mp 148–149°C, R_f 0.50. ^{1}H NMR spectrum, δ, ppm: 1.14–1.36 m (3H), 1.67 m (1H), 1.78–1.91 m (4H), and 2.06–2.21 m (2H) (C_6H_{11}); 3.35 t (2H, SCH$_2$, J = 6.5 Hz), 3.76 m (2H, C**H**$_2$OH), 3.88 s (3H, OCH$_3$), 3.96 m (1H, NCH), 4.81 t (1H, OH, J = 5.7 Hz), 7.02 m and 7.37 m (2H each, C_6H_4). Found, %: N 12.75; S 9.84. $C_{17}H_{23}N_3O_2S$. Calculated, %: N 12.60; S 9.61.

2-[4-Cyclohexyl-5-(4-ethoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]ethanol (IVo). Yield 87%, mp 129–130°C, R_f 0.55. ^{1}H NMR spectrum, δ, ppm: 1.16–1.34 m (3H), 1.67 m (1H), 1.78–1.94 m (4H), and 2.00–2.18 m (2H) (C_6H_{11}), 1.46 t (3H, CH$_2$C**H**$_3$, J = 7.0 Hz), 3.35 t (2H, SCH$_2$), 3.75 m (2H, C**H**$_2$OH), 3.99 m (1H, NCH), 4.10 q (2H, OCH$_2$, J = 7.0 Hz), 4.82 t (1H, OH), 6.98 m and 7.35 m (2H each, C_6H_4). Found, %: N 12.25; S 9.46. $C_{18}H_{25}N_3O_2S$. Calculated, %: N 12.09; S 9.22.

2-[4-Cyclohexyl-5-(4-propoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]ethanol (IVp). Yield 83%, mp 104–105°C, R_f 0.61. ^{1}H NMR spectrum, δ, ppm: 1.08 t (3H, CH$_2$C**H**$_3$, J = 7.4 Hz); 1.14–1.35 m (3H), 1.66 m (1H), 1.77–1.91 m (4H), and 2.13 m (2H) (C_6H_{11}); 1.84 m (2H, C**H**$_2$CH$_3$), 3.35 t (2H, SCH$_2$, J = 6.5 Hz), 3.76 m (2H, C**H**$_2$OH), 3.96 m (1H, NCH), 4.00 t (2H, OCH$_2$, J = 6.5 Hz), 4.82 t (1H, OH, J = 5.7 Hz), 7.00 m and 7.35 m (2H each, C_6H_4). Found, %: N 11.38; S 8.55. $C_{19}H_{27}N_3O_2S$. Calculated, %: N 11.62; S 8.86.

2-[4-Cyclohexyl-5-(4-isopropoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]ethanol (IVq). Yield 78%, mp 125–126°C, R_f 0.63. ^{1}H NMR spectrum, δ, ppm: 1.15–1.33 m (3H), 1.67 m (1H), 1.77–1.91 m (4H), and 2.07–2.23 m (2H, C_6H_{11}), 1.38 d [6H, CH(C**H**$_3$)$_2$, J = 6.0 Hz], 3.35 t (2H, SCH$_2$, J = 6.5 Hz), 3.76 m (2H, C**H**$_2$OH), 3.98 m (1H, NCH), 4.66 sept [1H, C**H**(CH$_3$)$_2$, J = 6.0 Hz], 4.81 t (1H, OH, J = 5.7 Hz), 6.97 m and 7.34 m (2H each, C_6H_4). Found, %: N 11.66; S 8.62. $C_{19}H_{27}N_3O_2S$. Calculated, %: N 11.62; S 8.86.

2-[5-(4-Butoxyphenyl)-4-cyclohexyl-4*H*-1,2,4-triazol-3-ylsulfanyl]ethanol (IVr). Yield 70%, mp 134–135°C, R_f 0.60. ^{1}H NMR spectrum, δ, ppm: 1.02 t (3H, CH$_2$C**H**$_3$); 1.15–1.35 m (3H), 1.66 m (1H), 1.74–1.96 m (4H), and 2.13 m (2H) (C_6H_{11}); 1.54 m (2H, C**H**$_2$CH$_3$), 1.81 m (2H, OCH$_2$C**H**$_2$), 3.35 t (2H, SCH$_2$, J = 6.5 Hz), 3.76 m (2H, C**H**$_2$OH), 3.96 m (1H, NCH), 4.04 t (2H, OCH$_2$, J = 6.3 Hz), 4.82 t (1H, OH, J = 5.7 Hz), 6.99 m and 7.35 m (2H each, C_6H_4). Found, %: N 11.32; S 8.75. $C_{20}H_{29}N_3O_2S$. Calculated, %: N 11.19; S 8.53.

2-[4-Cyclohexyl-5-(4-isobutoxyphenyl)-4*H*-1,2,4-triazol-3-ylsulfanyl]ethanol (IVs). Yield 94%, mp 126–127°C, R_f 0.59. ^{1}H NMR spectrum, δ, ppm: 1.07 t [6H, CH(C**H**$_3$)$_2$, J = 6.7 Hz]; 1.15–1.35 m (3H), 1.66 m (1H), 1.77–1.99 m (4H), and 2.13 m (2H) (C_6H_{11}); 2.12 sept [1H, C**H**(CH$_3$)$_2$, J = 6.7 Hz], 3.35 t (2H, SCH$_2$, J = 6.5 Hz), 3.75 m (2H, C**H**$_2$OH), 3.81 d (2H, OCH$_2$, J = 6.4 Hz), 3.96 m (1H, NCH), 4.82 t (1H, OH, J = 5.3 Hz), 7.00 m and 7.35 m (2H each, C_6H_4). Found, %: N 11.28; S 8.35. $C_{20}H_{29}N_3O_2S$. Calculated, %: N 11.19; S 8.53.

4-Cyclohexyl-5-(4-methoxyphenyl)-2-(morpholin-4-ylmethyl)-2*H*-1,2,4-triazole-3(4*H*)-thione (Va). Morpholine, 1 ml, was added to a solution of 0.15 g

(5 mmol) of thiol **IIIa** in 5 ml of ethanol, 4 ml of a formaldehyde solution was gradually added under shaking, and the mixture was kept for 6–7 h at 20–25°C. The precipitate was filtered off and recrystallized from 70% ethanol. Yield 0.12 g (70%), mp 104–105°C, R_f 0.71. ^{1}H NMR spectrum, δ, ppm: 1.11–1.31 m (3H), 1.63 m (1H), 1.78–1.99 m (4H), and 2.18 m (2H) (C_6H_{11}); 2.71 m (4H, NCH_2, morpholine), 3.58 m (4H, OCH_2, morpholine), 3.89 s (3H, OCH_3), 4.37 m (1H, NCH), 5.04 s (2H, NCH_2), 7.03 m and 7.40 m (2H each, C_6H_4). Found, %: N 14.56; S 8.35. $C_{20}H_{28}N_4O_2S$. Calculated, %: N 14.42; S 8.25.

4-Cyclohexyl-5-(4-ethoxyphenyl)-2-(morpholin-4-ylmethyl)-2*H*-1,2,4-triazole-3(4*H*)-thione (Vb) was synthesized in a similar way. Yield 75%, mp 138–139°C, R_f 0.59. ^{1}H NMR spectrum, δ, ppm: 1.11–1.30 m (3H), 1.62 m (1H), 1.78–1.99 m (4H), and 2.18 m (2H) (C_6H_{11}); 1.46 t (3H, $CH_2C\mathbf{H}_3$, J = 6.9 Hz), 2.74 m (4H, NCH_2, morpholine), 3.59 m (4H, OCH_2, morpholine), 4.12 q (2H, OCH_2, J = 6.9 Hz), 4.37 m (1H, NCH), 5.04 s (2H, NCH_2), 7.00 m and 7.38 m (2H each, C_6H_4). Found, %: N 13.75; S 7.68. $C_{21}H_{30}N_4O_2S$. Calculated, %: N 13.91; S 7.96.

The ^{1}H NMR spectra were recorded on a Varian Mercury-300 spectrometer at 300 MHz using DMSO-d_6 as solvent and tetramethylsilane as internal reference. The melting points were determined on a Boetius hot stage. Thin-layer chromatography was performed on Silufol UV-254 plates using benzene–acetone (2 : 1) (**IIIa**–**IIIf**, **Va**, **Vb**) or benzene–acetone–ethanol (1 : 1 : 0.1) (**IVa**–**IVs**) as eluent; spots were visualized under UV light.

Initial 2-(4-alkoxybenzoyl)-*N*-cyclohexylhydrazinecarbothioamides **IIa**–**IIf** were synthesized according to the procedure described in [3].

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