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SYNTHESIS AND TRANSFORMATIONS OF HYDRAZINECARBODITHIOATES CONTAINING THE 7-METHYL-5-OXO-5H-1,3,4-THIADIAZOLO[3,2-*a*]PYRIMIDIN-2-YL FRAGMENT

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The reaction of 2-hydrazino-7-methyl-5-oxo-5H-1,3,4-thiadiazolo[3,2-a]pyrimidine with carbon disulfide leads to the formation of hydrazinecarbodithioates and their cyclization products.

Derivatives of 2-hydrazino-7-methyl-5-oxo-5H-1,3,4-thiadiazolo[3,2-*a*]pyrimidine (II) are of obvious interest in view of their infrequent study [1, 2]. On the other hand, derivatives of 5-oxo-5H-1,3,4-thiadiazolo[3,2-*a*]pyrimidines, owing to their biological activity, have aroused considerable attention [3, 4].

The present work is devoted to derivatives of II potentially promising as materials for the chemical protection of cotton plants from pathogenic fungi.

As was shown in preliminary work, hydrazine II easily reacts with carbon disulfide in polar solvents in the presence of base with the formation of salts of hydrazine carbodithioic acids. In view of the limited solubility of II, DMF was used as solvent. Upon carrying out the process in boiling pyridine the carbodithioate salt underwent intramolecular cyclization to III. Compound III after conversion into the corresponding thiol was alkylated with benzyl chloride to the sulfide IV.

A plant-scale test of the synthesis of IV by direct interaction of benzylthiocyanate with hydrazine II in PFK at 90-100°C for 6-8 h. We assumed that the formation of intermediate A would be followed by intramolecular cyclization with the cleavage of the molecule of ammonia. However, we did not isolate the expected sulfide IV.

The alkali salt of the carbodithioic acid of II may be transformed without isolation into the corresponding esters V. Thus, treatment with benzyl chloride or sodium chloroacetate gave the esters Va and Vb, respectively. We expected that, owing to the presence of the carboxymethyl group, compound Vb would be capable of intramolecular cyclization in PFK or conc. H_2SO_4 into VI with subsequent cyclodehydration of the latter into 7-methyl-9-oxo-9H-2-thioxo-2H-thiazolo[3",4"-1',5']-1,2,4-triazolo[4',3'-4,5]-1,3,4-thiadiazolo[3,2-*a*]pyrimidine (VII), the condensed analog of III and IV. However, because of the considerable destruction of compounds V, the expected condensation product VII could not be isolated. Compound VI was obtained by reaction of I with 3-aminorhodanine, but the cyclodehydration of compound VI in PFK or conc. H_2SO_4 was unsuccessful.

Thus, the reaction of hydrazine II with carbon disulfide serves as a method of synthesis of the previously unknown hydrazinecarbodithioate esters Va and Vb and the 3-substituted 8-methyl-6-oxo-6H-1,2,4-triazolo[4',3'-4,5]-1,3,4-thiadiazolo-[3,2-*a*]pyrimidines (III and IV).

EXPERIMENTAL

The ^1H NMR spectra were determined on a Tesla BS-487 (80 MHz) instrument in DMSO, using HMDS as internal standard. The IR spectra were recorded with a UR-20 instrument in KBr tablets and as thin films in a concentration of 1:200 mg. The purity of the compounds obtained was monitored by TLC on standard Silufol UV-254 plates in a dioxane–alcohol–chloroform 3:3:1 system, with visualization with iodine vapor. Melting points were determined with a Boethius micro-hotstage.

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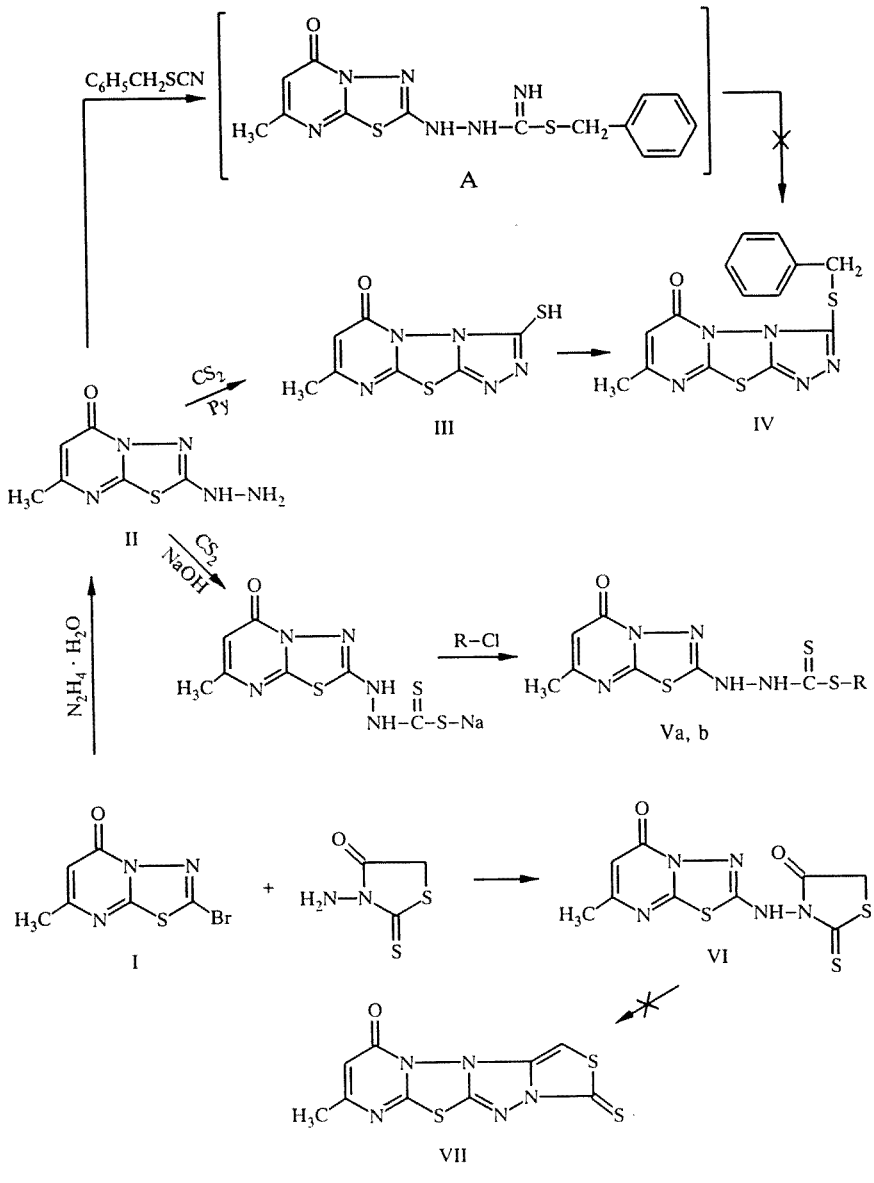

V a R = $CH_2C_6H_5$; b R = CH_2COOH

The elemental analysis data for the synthesized compounds corresponded with the calculated values.

3-Mercapto-8-methyl-6-oxo-1,2,4-triazolo[4',3 '-4,5]-1,3,4-thiadiazolo[3,2-*a*]pyrimidine (III, $C_7H_5N_5OS_2$). A mixture of 1.97 g (0.01 mole) of 2-hydrazino-7-methyl-5-oxo-5H-1,3,4-thiadiazolo[3,2-*a*]pyrimidine (II) [2] and 1.6 g (0.02 mole) of carbon disulfide in pyrimidine was stirred and boiled for 5 h. Upon completion of the reaction the pyridine was evaporated, the crystalline residue was triturated with ethanol, filtered, and crystallized from a 2:1 mixture of DMF and water to give mp 215-217°C. ^{1}H NMR spectrum: 10.22 (H, s, NH); 5.70 (H, s, CH); 1.87 ppm (3H, s, CH_3). IR spectrum: 3230 (N–H); 1670 (C=O); 1475 cm^{-1} (C=N). Yield 78%.

3-Benzylthio-8-methyl-6-oxo-1,2,4-triazolo[4',3'-4,5]-1,3,4-thiadiazolo[3,2-*a*]pyrimidine (IV, $C_{14}H_{11}N_5OS_2$). A mixture of 2.39 g (0.01 mole) of III and 0.4 g (0.01 mole) of NaOH in 25 ml of DMF was stirred until complete solution. Then 1.26 g (0.01 mole) of benzyl chloride was added and the mixture was stirred for an additional 1.5 h to neutral reaction with universal indicator. Upon completion of the reaction, the mixture was diluted with water and the resulting precipitate was filtered off and recrystallized from dioxane to give mp 148-152°C. ^{1}H NMR spectrum: 7.30 (5H, s, Ph); 5.85 (H, s, CH); 4.32 (2H, s, CH_2); 2.78 ppm (3H, s, CH_3). IR spectrum: 1680 (C=O); 1560 cm^{-1} (C=N). Yield 84%.

Carboxymethyl 2-(7-Methyl-5-oxo-5H-1,3,4-thiadiazolo[3,2-*a*]pyrimidin-2-yl)hydrazinecarbodithioate (Vb, $C_9H_9N_5O_3S_3$). A mixture of 1.97 g (0.01 mole) of II and 0.79 g (0.01 mole) of carbon disulfide and 0.4 g (0.01 mole) of sodium hydroxide in 25 ml of DMF was stirred at 0°C until solution was complete. Then a solution of sodium chloroacetate

(from 0.94 g of chloroacetic acid and 0.4 g of NaOH in 10 ml of water) was added and the stirring was continued for an additional 3 h. After completion of the reaction, the mixture was diluted with water, the solution was neutralized with dilute HCl, and the resulting precipitate was filtered off to give mp 228-229°C. ^{1}H NMR spectrum: 10.2 (H, s, NH); 5.82 (H, s, CH); 3.92 (2H, s, CH_2); 2.07 ppm (3H, s, CH_3). IR spectrum: 3450 (COOH); 3275 (NH); 1670 (C=O); 1535 cm^{-1} (C=N). Yield 74%.

Benzyl 2-(7-Methyl-5-oxo-5H-1,3,4-thiadiazolo[3,2-*a*]pyrimidin-2-yl)hydrazinecarbodithioate (Va, $C_{14}H_{13}N_5OS_3$) was obtained analogously with Vb to give mp 179-181°C. ^{1}H NMR spectrum: 10.30 (H, s, NH); 7.27 (5H, m, Ph); 5.82 (H, s, CH); 4.07 (2H, s, CH_2); 2.07 ppm (3H, s, CH_3). IR spectrum: 3200 (NH); 1685 (C=O); 1545 cm^{-1} (C=N). Yield 83%.

2-(4-Oxo-2-thioxothiazolidin-3-yl)amino-7-methyl-5-oxo-5H-1,3,4-thiadiazolo[3,2-*a*]pyrimidine (VI, $C_8H_7N_5O_2S_3$). To a solution of 2.46 g (0.01 mole) of 2-bromo-7-methyl-5-oxo-5H-1,3,4-thiadiazolo[3,2-*a*]pyrimidine (I) [5] in 20 ml of benzene was added 1.48 g (0.01 mole) of aminorhodanine [6] and the mixture was stirred and boiled for 3 h. The solvent was evaporated, the residue was washed with water, and crystallized from dioxane to give mp 112-114°C. ^{1}H NMR spectrum: 6.20 (H, s, CH); 4.15 (2H, s, CH_2); 2.20 ppm (3H, s, CH_3). IR spectrum: 3230 (NH); 1730 (C=O); 1490 cm^{-1} (C=N). Yield 65%.

REFERENCES

1. T. Okabe, E. Taniguche, and K. Maekawa, Bull. Chem. Soc., Japan, **47**, 2813 (1974).
2. S. Sh. Shukurov, D. A. Artykova, S. S. Dzhalolov, I. M. Nasyrov, and K. S. Zakharov, Izv. Vuzov. Khim. Khim. Tekhnol., No. 5, 29 (1993).
3. D. Doria, K. Passarotti, and A. Buttinoni, USSR 1,297,731, Byull. Izobret., No. 10, 289 (1987).
4. D. Doria, K. Passarotti, and A. Buttinoni, USSR 1,321,377, Byull. Izobret., No. 24, 265 (1987).
5. S. Sh. Shukurov, I. M. Nasyrov, M. A. Kukaniev, L. P. Skotnikova, D. A. Artykova, M. N. Gal'perina, K. Kh. Khaidarov, Author's Cert. 1,648,068, Byull. Izobret., No. 17, 270 (1991).
6. Methods for Obtaining Chemical Reagents and Preparations [in Russian], Issue 23, Institute of Chem. Reagents, Moscow (1971), p. 13.