Synthesis and Fungicidal Activities of New 1,2,4-Triazolo[1,5-*a*]pyrimidines

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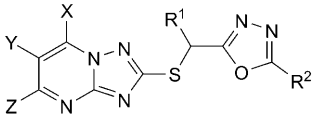
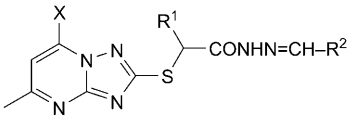
A series of new acetohydrazone-containing 1,2,4-triazolo[1,5-*a*]pyrimidine derivatives were designed and synthesized for the purpose of searching for novel agrochemicals with higher fungicidal activity. Their *in vitro* fungicidal activities against *Rhizoctonia solani* were evaluated, and the most promising compound, 2-[(5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-2′-[(2-hydroxyphenyl)methylidene]acetohydrazide (**2-17**), showed a lower EC_{50} value (5.34 μg ml^{-1}) than that of commercial carbendazim (EC_{50} = 7.62 μg ml^{-1}). Additionally, compound **2-17** was also found to display broad-spectrum fungicidal activities, and its EC_{50} value (4.56 μg ml^{-1}) against *Botrytis cinereapers* was very similar to that of carbendazim. Qualitative structure–activity relationships (QSARs) of the synthesized compounds were also discussed.

1. Introduction. – Triazolo[1,5-*a*]pyrimidine derivatives have attracted a lot of attention from medicinal and agricultural chemists due to their broad-spectrum biological activities [1–9], *i.e.*, as cardiovascular vasodilators [1], calcium channel-blocking agents, and potassium-channel inhibitors and openers. Some triazolopyrimidine-2-sulfonamide derivatives, such as metosulam [6], flumetsulam [7], and florasulam [8], have also been used as herbicides for many years [9]. Recently, many triazolopyrimidine derivatives have been patented for their fungicidal activities [10]. To search for new triazolopyrimidines with potent fungicidal activities, we previously designed and synthesized a series of 1,3,4-oxadiazole-containing compounds **1**, some of which were found to display good fungicidal activity against *Rhizoctonia solani*. However, these compounds displayed a narrow fungicidal spectrum. Keeping in mind that the acetohydrazone derivatives always displayed interesting biological activities [11][12], we designed and synthesized a series of new 1,2,4-triazolo[1,5-*a*]pyrimidine derivatives, **2** and **3**, by incorporating the pharmacophore of acetohydrazone with the aim of discovery of new lead compounds with more potent and broad-spectrum fungicidal activities.

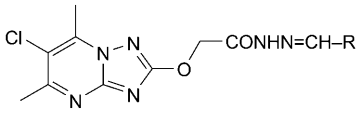
2. Results and Discussion. – 2.1. *Chemistry.* The target compounds **2** and **3** were synthesized by a multiple-step procedure as shown in the *Scheme.* In *Route A*, the starting material **4**, prepared according to our previously described procedures [12], reacted with various benzaldehydes to afford the target compounds **2-1**–**2-40** in yields of 57–97%. In *Route B*, 6-chloro-5,7-dimethyl-2-(methylsulfanyl)-1,2,4-triazolo[1,5-*a*]pyrimidine (**5**), easily prepared by the cyclization reaction of 3-amino-5-(methyl-



1 X, Y, Z, R^1 = Me, H
R^2 = various substituents



2 X, R^1 = Me, H
R^2 = various substituents

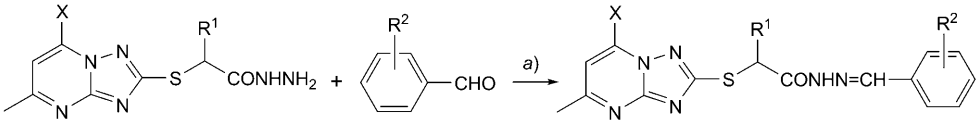


3 R = various substituents

sulfanyl)-1,2,4-triazole with 3-chloropentane-2,4-dione, was oxidized by H_2O_2 in AcOH to give 6-chloro-5,7-dimethyl-(2-methylsulfonyl)-1,2,4-triazolo[1,5-*a*]pyrimidine (**6**) in a yield of 91%. Then, **6** was reacted with ethyl 2-hydroxyacetate under basic conditions

Scheme

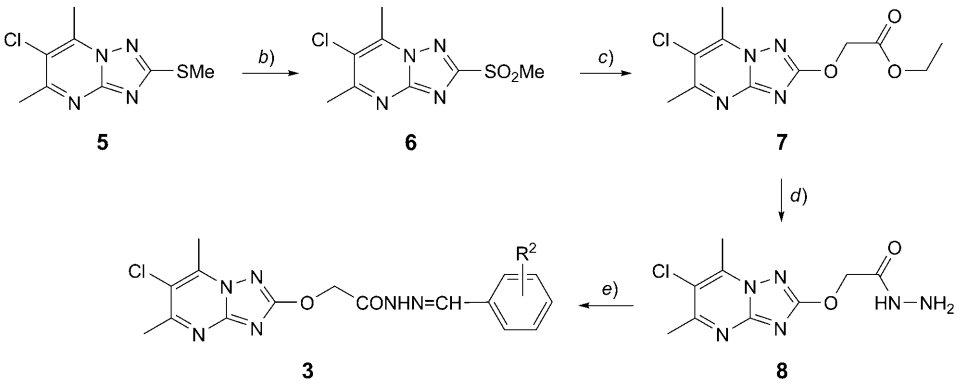
Route A



4 X, R^1 = Me, H

2 X, R^1 = Me, H
R^2 = various substituents

Route B



a) EtOH, r.t. *b*) H_2O_2, AcOH, 60°. *c*) $HOCH_2COOEt$, NaH, toluene, reflux. *d*) $NH_2NH_2 \cdot H_2O$, EtOH, reflux. *e*) Substituted benzaldehyde, EtOH, r.t.

to afford ethyl 2-[(6-chloro-5,7-dimethyl-1,2,4-triazolo[1,5-*a*]pyrimidin-2-yl)oxy]acetate (**7**), which reacted subsequently with 1 equiv. of $NH_2NH_2 \cdot H_2O$ to afford 2-[(6-chloro-5,7-dimethyl-1,2,4-triazolo[1,5-*a*]pyrimidin-2-yl)oxy]acetohydrazide (**8**) in 82% yield. Finally, the desired hydrazides **3-1**–**3-9** were obtained in 60–80% yields by the reaction of compound **8** with various benzaldehydes. The experimental results indicated that the reactivity of the benzaldehyde determined the reaction time and the yields of compounds **2** and **3**. The reaction of benzaldehydes bearing an electron-withdrawing group proceeded more smoothly than those bearing an electron-donating group. The structures of all of the new compounds were characterized by ^{1}H-NMR, MS, and elemental analyses. In addition, the crystal structure of **2-3** was determined by X-ray diffraction analysis (*Fig.*).

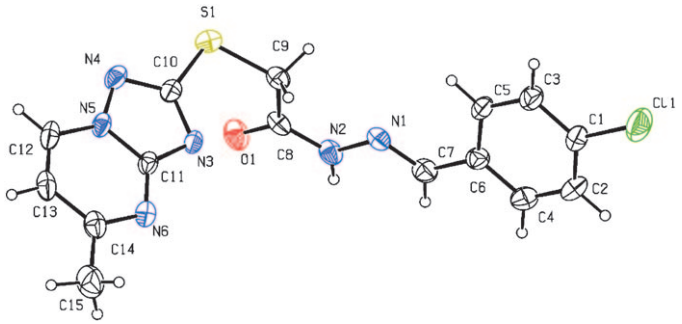
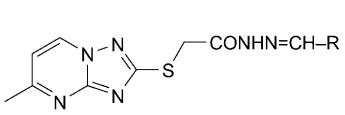


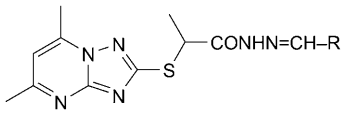
Figure. *ORTEP Plot* [13] *of compound* **2-3**. Displacement ellipsoids are drawn at the 30% probability level.

2.2. *Fungicidal Activity and SAR*. The EC_{50} values against *R. solani* of compounds **2**, **3**, and carbendazim were listed in *Table 1*. For the sake of clarity, according to the substitution patterns at the triazolopyrimidine ring, compounds **2-1**–**2-20**, **2-21**–**2-40**, and **3-1**–**3-9** will be named monosubstituted (MS), disubstituted (DS), and trisubstituted (TS) derivatives, respectively, through the text. As indicated in *Table 1*, compound **2-17** (EC_{50} = 5.34 μg ml^{-1}) exhibited the highest fungicidal activity against *R. solani*, which is higher than that of carbendazim (EC_{50} = 7.62 μg ml^{-1}). In addition, some compounds, such as **2-5** (EC_{50} = 8.01 μg ml^{-1}), **2-6** (EC_{50} = 7.28 μg ml^{-1}), **2-22** (EC_{50} = 7.62 μg ml^{-1}), and **2-32** (EC_{50} = 7.30 μg ml^{-1}), were found to display comparable fungicidal activity as carbendazim. Although it is difficult to derive quantitative structure–activity relationships (QSARs), some interesting phenomena could be deduced from *Table 1*. For example, halogenated MS derivatives always displayed higher activity than the corresponding halogenated TS derivatives (**2-1** > **3-1**, **2-3** > **3-2**, and **2-6** > **2-14**), TS Derivatives bearing an electron-donating substituent always displayed higher activity than the corresponding MS and DS derivatives (**3-5** > **2-36** > **2-19** and **3-6** > **2-35** > **2-13**). Of the phenyl-substitution patterns investigated within the DS and TS derivatives bearing two electron-donating substituents, 2,5-disubstitution (*i.e.*, **2-32**, **2-33**, and **2-34**) displayed higher activity than 2,4-disubstitution (*i.e.*, **2-31**) and 3,4-disubstitution (*i.e.*, **2-39**). However, 2,4-disubstitution (*i.e.*, **3-7**)

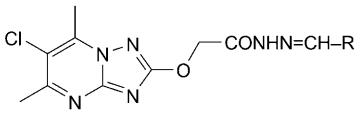
Table 1. *Determination of* EC_{50} *Values against* R. solani *of Compounds* **2** *and* **3**



2-1 – 2-20



2-21 – 2-40



3-1 – 3-9

	R	$y=ax+b$[a])	r[b])	EC_{50} [μg ml^{-1}]		R	$y=ax+b$[a])	r[b])	EC_{50} [μg ml^{-1}]
2-1	2-ClC_6H_4	$y=1.17x+3.51$	0.9674	18.6±0.5	**2-26**	2-FC_6H_4	$y=2.73x+1.25$	0.9917	23.6±0.5
2-2	3-ClC_6H_4	$y=1.02x+3.47$	0.9549	32.5±0.5	**2-27**	3-FC_6H_4	$y=2.31x+2.22$	0.9890	15.9±0.4
2-3	4-ClC_6H_4	$y=1.05x+3.66$	0.9233	18.8±0.4	**2-28**	2-$NO_2C_6H_4$	$y=2.09x+2.29$	0.9948	19.6±0.3
2-4	2,4-$Cl_2C_6H_3$	$y=1.17x+3.45$	0.9719	20.8±0.5	**2-29**	3-$NO_2C_6H_4$	$y=2.29x+1.94$	0.9767	21.4±0.3
2-5	3,4-$Cl_2C_6H_3$	$y=1.23x+3.89$	0.9614	8.0±0.1	**2-30**	4-$NO_2C_6H_4$	$y=1.77x+3.12$	0.9409	11.6±0.2
2-6	4-FC_6H_4	$y=0.60x+4.49$	0.9160	7.3±0.2	**2-31**	2-HO,4-$MeOC_6H_3$	$y=2.85x+1.62$	0.9764	17.1±0.3
2-7	2-FC_6H_4	$y=1.11x+3.25$	0.9373	38.4±0.5	**2-32**	2-HO,5-$MeOC_6H_3$	$y=1.72x+3.52$	0.9527	7.3±0.1
2-8	2-Cl,6-FC_6H_3	$y=1.29x+3.33$	0.8901	19.7±0.4	**2-33**	2-HO,5-BrC_6H_3	$y=2.14x+2.69$	0.9544	12.1±0.2
2-9	3-BrC_6H_4	$y=1.06x+3.49$	0.9097	26.4±0.4	**2-34**	2-HO,5-ClC_6H_3	$y=2.19x+2.30$	0.9586	16.9±0.3
2-10	2-$NO_2C_6H_4$	$y=1.09x+3.31$	0.9583	35.5±0.6	**2-35**	4-$MeOC_6H_4$	$y=2.19x+2.08$	0.9853	21.6±0.4
2-11	3-$NO_2C_6H_4$	$y=1.27x+3.46$	0.9784	16.4±0.4	**2-36**	4-MeC_6H_4	$y=1.96x+2.50$	0.9933	18.7±0.3
2-12	4-$NO_2C_6H_4$	$y=0.87x+3.63$	0.9585	36.9±0.4	**2-37**	4-HOC_6H_4	$y=2.43x+1.57$	0.9949	25.7±0.4
2-13	4-$MeOC_6H_4$	$y=1.25x+3.19$	0.9590	28.2±0.5	**2-38**	4-$Me_2NC_6H_4$	$y=1.96x+2.78$	0.9394	13.5±0.2
2-14	4-HO,3-$MeOC_6H_3$	$y=2.09x+2.99$	0.8786	9.0±0.1	**2-39**	4-HO,3-$MeOC_6H_3$	$y=1.39x+3.04$	0.8907	25.9±0.4
2-15	4-HOC_6H_4	$y=0.94x+3.47$	0.9239	41.7±0.3	**2-40**	Ph	$y=1.46x+2.98$	0.9615	23.9±0.4
2-16	2,4-$(HO)_2C_6H_3$	$y=1.05x+3.8$	0.9250	15.2±0.2	**3-1**	2-ClC_6H_4	$y=1.45x+3.07$	0.9377	21.4±0.5
2-17	2-HOC_6H_4	$y=2.03x+3.52$	0.9307	5.3±0.1	**3-2**	4-ClC_6H_4	$y=1.66x+2.81$	0.9660	20.7±0.4
2-18	4-$Me_2NC_6H_4$	$y=1.44x+2.92$	0.9935	28.3±0.3	**3-3**	3-FC_6H_4	$y=1.27x+3.42$	0.8802	17.5±0.4
2-19	4-MeC_6H_4	$y=1.32x+3.31$	0.9241	19.1±0.2	**3-4**	4-FC_6H_4	$y=1.25x+3.51$	0.8569	15.6±0.3
2-20	Ph	$y=1.50x+2.91$	0.9946	24.6±0.4	**3-5**	4-MeC_6H_4	$y=0.77x+4.21$	0.9438	10.8±0.2
2-21	4-ClC_6H_4	$y=2.01x+2.35$	0.9963	20.7±0.4	**3-6**	4-$MeOC_6H_4$	$y=1.36x+3.46$	0.9670	13.7±0.2
2-22	3-ClC_6H_4	$y=1.92x+3.31$	0.9394	7.6±0.1	**3-7**	2-HO,4-$MeOC_6H_3$	$y=1.68x+3.12$	0.9197	13.1±0.3
2-23	2-ClC_6H_4	$y=1.30x+3.28$	0.9570	20.9±0.3	**3-8**	2-HO,5-$MeOC_6H_3$	$y=1.11x+3.68$	0.9262	15.4±0.3
2-24	3,4-$Cl_2C_6H_3$	$y=1.63x+2.77$	0.9896	23.4±0.3	**3-9**	2-HO,5-BrC_6H_3	$y=1.37x+3.40$	0.8957	14.8±0.2
2-25	2-Cl,6-FC_6H_3	$y=2.05x+2.11$	0.9991	25.5±0.4	Carbendazim		$y=3.82x+1.63$	0.9443	7.6±0.1

[a]) Correlation equations for the determination of EC_{50} values. [b]) Correlation coefficients of the equations.

displayed higher activity than 2,5-disubstitution (*i.e.*, **3-8** and **3-9**) within the TS derivatives bearing electron-donating groups. With respect to the substituents of investigated MS derivatives, the order of increasing fungicidal activity could be summarized as follows: OH (**2-17**) ≫ Cl (**2-1**) > NO_2 (**2-10**) > F (**2-7**) at position 2, NO_2 (**2-11**) > Br (**2-9**) > Cl (**2-2**) at position 3, F (**2-6**) > Cl (**2-3**) > Me (**2-19**) > MeO (**2-13**) ≈ Me_2N (**2-18**) > NO_2 (**2-12**) > OH (**2-15**) at position 4.

In addition, the EC_{50} values against *Fusarium oxysporium*, *Botrytis cinereapers*, *Gibberella zeae*, *Dothiorella gregaria*, and *Colletotrichum gossypii* of highly active compounds **2-5**, **2-6**, **2-17**, **2-22**, **2-32**, and carbendazim were collected in *Table 2*. All compounds except **2-22** displayed the most potent fungicidal activity against *B. cinereapers* among the five tested fungi. Fortunately, compound **2-17** was found to display fungicidal activity comparable with that of carbendazim against *B. cinereapers.*

Table 2. *Fungicidal Spectrum* (EC_{50} in μg ml^{-1}) *of Some Representative Compounds*

Compound	*F. oxysporium*	*B. cinereaper*	*G. zeae*	*D. gregaria*	*C. gossypii*
2-5	9.6±0.4	5.8±0.3	13.8±0.5	18.8±0.4	13.7±0.4
2-6	9.7±0.4	5.3±0.3	13.3±0.4	13.1±0.4	18.5±0.8
2-17	12.8±0.5	4.6±0.2	14.7±0.4	20.1±0.5	16.0±0.4
2-22	8.5±0.3	14.6±0.5	17.2±0.4	18.7±0.4	16.4±0.4
2-32	15.0±0.7	8.9±0.3	15.5±0.5	16.7±0.4	22.6±0.6
Carbendazim	2.0±0.1	3.6±0.1	0.9±0.1	0.8±0.1	1.2±0.1

3. Conclusions. – In summary, a series of new 1,2,4-triazolo[1,5-*a*]pyrimidine derivatives with fungicidal activity were designed and synthesized by incorporating the pharmacophore of acetohydrazone within the scaffold of triazolo[1,5-*a*]pyrimidine. Two compounds, **2-17** and **2-32**, were found to display higher fungicidal activities than carbendazim against *R. solani*, while compound **2-17** displayed fungicidal activity comparable with that of carbendazim against *B. cinereapers.* Further structural optimizations are underway.

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Experimental Part

General. All chemical reagents were commercially available and treated according to standard methods before use. Solvents were dried in a routine way and redistilled. Intermediates were prepared according to previously reported methods [12][14][15]. *Rhizoctonia solani*, *Fusarium oxysporium*, *Botrytis cinereapers*, *Gibberella zeae*, *Dothiorella gregaria*, and *Colletotrichum gossypii* were provided through the courtesy of the Center for Bioassay, The Environment and Plant Protection Institute of Chinese Academy of Tropical Agricultural Sciences. M.p.: *Electrothermal* digital melting-point apparatus; uncorrected. ^{1}H-NMR Spectra: *Varian Mercury* spectrometer, at 300 MHz, in (D_6)DMSO; δ in ppm rel. to TMS, *J* in Hz. MS: *Finnigan Trace MS* organic mass spectrometer; in *m*/*z*. Elemental analysis: *Vario EL III* instrument.

*2-[(5-Methyl-1,2,4-triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]acetohydrazide* (X = H, R^1 = H; **4a**). A mixture of 12.6 g (0.05 mol) of 2-[(5-methyl-1,2,4-triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]acetate and

2.94 g (0.05 mol) of 85% $NH_2NH_2 \cdot H_2O$ in 200 ml of EtOH was heated at 60° for 4 h. The mixture was cooled to r.t., and the precipitate was filtered and recrystallized from MeOH to give pure **4a** (8.09 g, 68%). White crystals. M.p. 170–172°. ^{1}H-NMR (400 MHz): 9.36 (*s*, 1 H); 9.12 (*d*, *J* = 6.8, 1 H); 7.20 (*d*, *J* = 6.4, 1 H); 4.33 (*s*, 2 H); 3.95 (*s*, 2 H); 2.60 (*s*, 3 H).

*2-[(5,7-Dimethyl-1,2,4-triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]propanohydrazide* (X = Me, R^1 = Me; **4b**). A mixture of 14.0 g (0.05 mol) of 2-[(5,7-dimethyl-1,2,4-triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]propanoate and 20.6 g (0.35 mol) of 85% $NH_2NH_2 \cdot H_2O$ in 200 ml of EtOH was refluxed for 7 h. The mixture was cooled to r.t., and the precipitate was filtered and recrystallized from MeOH to give pure **4b** (10.51 g, 79%). White crystals. M.p. 104–106°. ^{1}H-NMR (400 MHz): 9.47 (*s*, 1 H); 7.13 (*s*, 1 H); 4.50 (*q*, *J* = 6.8, 1 H); 4.35 (*s*, 2 H); 2.68 (*s*, 3 H); 2.56 (*s*, 3 H); 1.56 (*d*, *J* = 7.2, 3 H).

*6-Chloro-5,7-dimethyl-2-(methylsulfanyl)-1,2,4-triazolo[1,5-*a*]pyrimidine* (**5**). A soln. of 6.50 g (0.05 mol) of 3-amino-5-(methylsulfanyl)-1,2,4-triazole and 6.75 g (0.05 mol) of 3-chloropentane-2,4-dione in 25 ml of glacial AcOH was heated at reflux for 18 h and poured into 150 ml of ice-H_2O. The precipitate was filtered and recrystallized from EtOH to give pure **5** (10.49 g, 92%). White crystals. M.p. 155–157°. ^{1}H-NMR (400 MHz): 2.89 (*s*, 3 H); 2.74 (*s*, 3 H); 2.72 (*s*, 3 H).

*6-Chloro-5,7-dimethyl-2-(methanesulfonyl)-1,2,4-triazolo[1,5-*a*]pyrimidine* (**6**). To a soln. of 2.29 g (10 mmol) of **5** dissolved in 20 ml of anh. CH_2Cl_2 was slowly added 1.73 g (10 mmol) of *m*-chloroperbenzoic acid (*m*CPBA), maintaining the temp. of the mixture below 0°. Stirring was continued at r.t., until the reaction was complete (TLC, acetone/petroleum ether (PE) 2:1). Then, 50 ml of H_2O was added, the mixture was extracted with CH_2Cl_2 (3 × 10 ml), the org. phase was washed with sat. $NaHCO_3$ soln. and H_2O, and the separated org. phase was dried (anh. Mg_2SO_4). After the filtrate had been evaporated, the residue was recrystallized from EtOH to give pure **6** (2.37 g, 91%). White solid. M.p. 178–179°. ^{1}H-NMR (400 MHz): 3.42 (*s*, 3 H); 3.02 (*s*, 3 H); 2.85 (*s*, 3 H).

*Ethyl [6-Chloro-5,7-dimethyl-1,2,4-triazolo[1,5-*a*]pyrimidin-2-yl)oxy]acetate* (**7**). A mixture of 4.38 g (0.04 mol) of ethyl hydroxyacetate and 1.80 g (0.045 mol) of NaH (60%) in 150 ml of anh. toluene was stirred at 55–60° for 1 h, then 5.2 g (0.02 mol) of **6** was added, and the mixture was refluxed, until the reaction was complete (TLC, acetone/PE 2:1). The mixture was cooled to r.t., and, after diatomite filtration, the solvent was removed under reduced pressure. The residue was recrystallized from acetone/PE 1:3 to give pure **7** (4.54 g, 80%). White solid. M.p. 96–98°. ^{1}H-NMR (400 MHz): 5.03 (*s*, 2 H); 4.25 (*q*, *J* = 7.2, 2 H); 2.87 (*s*, 3 H); 2.72 (*s*, 3 H); 1.29 (*t*, *J* = 7.2, 3 H).

*2-[(6-Chloro-5,7-dimethyl-1,2,4-triazolo[1,5-*a*]pyrimidin-2-yl)oxy]acetohydrazide* (**8**). A mixture of 2.85 g (0.01 mol) of **7** and 4.12 g (0.07 mol) of 85% $NH_2NH_2 \cdot H_2O$ in 55 ml of EtOH was refluxed for 7 h. The mixture was cooled to r.t., and the precipitate was filtered and recrystallized from EtOH to give pure **8** (2.21 g, 82%). White crystals. M.p. 174–176°. ^{1}H-NMR (400 MHz): 9.38 (*s*, 1 H); 4.83 (*s*, 2 H); 4.33 (*s*, 2 H); 2.77 (*s*, 3 H); 2.66 (*s*, 3 H).

General Procedure for the Synthesis of the Target Compounds **2** *and* **3**. A mixture of intermediate **4** or **8** (5 mmol) dissolved in 30 ml of EtOH and 6 mmol of substituted benzaldehyde was refluxed until the reaction was complete (TLC, acetone/PE 2:1). Then, the mixture was cooled to r.t., and the precipitate was filtered and recrystallized from DMF/EtOH to give pure products **2** or **3** in yields of 60–97%.

*2′-[(2-Chlorophenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]acetohydrazide* (**2-1**). Yield 94%. White solid. M.p. 168–169°. ^{1}H-NMR: 11.89, 12.07 (2*s*, NH); 9.17 (*d*, *J* = 7.2, CH); 8.44, 8.64 (2*s*, CH); 7.45–8.02 (*m*, 4 arom. H); 7.21 (*d*, *J* = 7.2, CH); 4.15, 4.58 (2*s*, CH_2S); 2.61 (*s*, Me). EI-MS: 360.9 (M^+). Anal. calc. for $C_{15}H_{13}ClN_6OS$ (360.82): C 49.93, H 3.63, N 23.29; found: C 50.07, H 3.42, N 23.50.

*2′-[(3-Chlorophenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]acetohydrazide* (**2-2**). Yield 91%. White solid. M.p. 218–220°. ^{1}H-NMR: 11.70, 11.82 (2*s*, NH); 9.11 (*d*, *J* = 7.2, CH); 8.02, 8.22 (2*s*, CH); 7.46–7.74 (*m*, 4 arom. H); 7.18 (*d*, *J* = 7.2, CH); 4.14, 4.54 (2*s*, CH_2S); 2.60 (*s*, Me). EI-MS: 360.7 (M^+). Anal. calc. for $C_{15}H_{13}ClN_6OS$ (360.82): C 49.93, H 3.63, N 23.29; found: C 50.20, H 3.47, N 22.91.

*2′-[(4-Chlorophenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]acetohydrazide* (**2-3**). Yield 83%. White solid. M.p. 232–234°. ^{1}H-NMR: 11.72, 11.83 (2*s*, NH); 9.14 (*d*, *J* = 7.2, CH); 8.05, 8.24 (2*s*, CH); 7.51–7.55 (*m*, 4 arom. H); 7.20 (*d*, *J* = 7.2, CH); 4.14, 4.55 (2*s*, CH_2S); 2.61 (*s*,

Me). EI-MS: 360.75 (M^+). Anal. calc. for $C_{15}H_{13}ClN_6OS$ (360.82): C 49.93, H 3.63, N 23.29; found: C 50.18, H 3.82, N 23.47.

2′-[(2,4-Dichlorophenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-a]pyrimidin-2-yl)sulfanyl]-acetohydrazide (**2-4**). Yield 94%. Yellowy solid. M.p. 237–239°. ^{1}H-NMR: 11.93, 12.05 (2*s*, NH); 9.13 (*d*, *J* = 6.6, CH); 8.04, 8.25 (2*s*, CH); 7.50–8.01 (*m*, 3 arom. H); 7.19 (*d*, *J* = 6.6, CH); 4.16, 4.57 (2*s*, CH_2S); 2.62 (*s*, Me). EI-MS: 395.3 (M^+). Anal. calc. for $C_{15}H_{12}Cl_2N_6OS$ (395.27): C 45.58, H 3.06, N 21.26; found: C 45.84, H 2.90, N 21.50.

2′-[(3,4-Dichlorophenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-a]pyrimidin-2-yl)sulfanyl]-acetohydrazide (**2-5**). Yield 97%. Yellowy solid. M.p. 222–224°. ^{1}H-NMR: 11.81, 11.96 (2*s*, NH); 9.12 (*d*, *J* = 6.6, CH); 8.02, 8.22 (2*s*, CH); 7.70–7.93 (*m*, 3 arom. H); 7.20 (*d*, *J* = 6.6, CH); 4.17, 4.57 (2*s*, CH_2S); 2.61 (*s*, Me). EI-MS: 394.9 (M^+). Anal. calc. for $C_{15}H_{12}Cl_2N_6OS$ (395.27): C 45.58, H 3.06, N 21.26; found: C 45.23, H 3.40, N 21.53.

2′-[(4-Fluorophenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-a]pyrimidin-2-yl)sulfanyl]aceto-hydrazide (**2-6**). Yield 94%. White solid. M.p. 228–230°. ^{1}H-NMR: 11.68, 11.79 (2*s*, NH); 9.14 (*d*, *J* = 6.9, CH); 8.03, 8.22 (2*s*, CH); 7.21–7.79 (*m*, 4 arom. H); 7.19 (*d*, *J* = 6.9, CH); 4.13, 4.55 (2*s*, CH_2S); 2.60 (*s*, Me). EI-MS: 344.4 (M^+). Anal. calc. for $C_{15}H_{13}FN_6OS$ (344.33): C 52.32, H 3.81, N 24.40; found: C 52.60, H 4.02, N 24.69.

2′-[(2-Fluorophenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-a]pyrimidin-2-yl)sulfanyl]aceto-hydrazide (**2-7**). Yield 88%. White solid. M.p. 171–173°. ^{1}H-NMR: 11.75, 11.96 (2*s*, NH); 9.12 (*d*, *J* = 7.2, CH); 8.24, 8.46 (2*s*, CH); 7.19–7.92 (*m*, 4 arom. H); 7.17 (*d*, *J* = 7.2, CH); 4.14, 4.55 (2*s*, CH_2S); 2.60 (*s*, Me). EI-MS: 344.5 (M^+). Anal. calc. for $C_{15}H_{13}FN_6OS$ (344.37): C 52.32, H 3.81, N 24.40; found: C 52.07, H 3.53, N 20.71.

2′-[(2-Chloro-6-fluorophenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-a]pyrimidin-2-yl)sulfa-nyl]acetohydrazide (**2-8**). Yield 92%. White solid. M.p. 198–201°. ^{1}H-NMR: 11.86, 12.00 (2*s*, NH); 9.13 (*d*, *J* = 6.9, CH); 8.30, 8.48 (2*s*, CH); 7.31–7.51 (*m*, 3 arom. H); 7.19 (*d*, *J* = 6.9, CH); 4.16, 4.50 (2*s*, CH_2S); 2.60 (*s*, Me). EI-MS: 379.1 (M^+). Anal. calc. for $C_{15}H_{12}ClFN_6OS$ (378.81): C 45.58, H 3.06, N 21.26; found: C 45.42, H 3.40, N 21.50.

2′-[(3-Bromophenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-a]pyrimidin-2-yl)sulfanyl]aceto-hydrazide (**2-9**). Yield 95%. White solid. M.p. 224–227°. ^{1}H-NMR: 11.76, 11.90 (2*s*, NH); 9.14 (*d*, *J* = 6.9, CH); 8.02, 8.21 (2*s*, CH); 7.39–7.90 (*m*, 4 arom. H); 7.19 (*d*, *J* = 6.9, CH); 4.15, 4.56 (2*s*, CH_2S); 2.61 (*s*, Me). EI-MS: 404.8 (M^+). Anal. calc. for $C_{15}H_{13}BrN_6OS$ (405.27): C 44.45, H 3.23, N 20.74; found: C 44.20, H 3.50, N 21.01.

2-[(5-Methyl[1,2,4]triazolo[1,5-a]pyrimidin-2-yl)sulfanyl]-2′-[(2-nitrophenyl)methylidene]acetohy-drazide (**2-10**). Yield 90%. Yellowy solid. M.p. 199–200°. ^{1}H-NMR: 11.64, 11.83 (2*s*, NH); 8.64 (*d*, *J* = 6.6, CH); 8.40, 8.61 (2*s*, CH); 7.56–8.30 (*m*, 4 arom. H); 7.03 (*d*, *J* = 6.6, CH); 3.98, 4.61 (2*s*, CH_2S); 2.69 (*s*, Me). EI-MS: 371.6 (M^+). Anal. calc. for $C_{15}H_{13}N_7O_3S$ (371.37): C 48.51, H 3.53, N 26.40; found: C 48.72, H 3.75, N 26.12.

2-[(5-Methyl[1,2,4]triazolo[1,5-a]pyrimidin-2-yl)sulfanyl]-2′-[(3-nitrophenyl)methylidene]acetohy-drazide (**2-11**). Yield 83%. Yellowy solid. M.p. 215–217°. ^{1}H-NMR: 11.88, 12.02 (2*s*, NH); 9.11 (*d*, *J* = 6.6, CH); 8.17, 8.37 (2*s*, CH); 7.71–8.52 (*m*, 4 arom. H); 7.20 (*d*, *J* = 6.6, CH); 4.19, 4.60 (2*s*, CH_2S); 2.61 (*s*, Me). EI-MS: 371.7 (M^+). Anal. calc. for $C_{15}H_{13}N_7O_3S$ (371.37): C 48.51, H 3.53, N 26.40; found: C 48.61, H 3.29, N 26.58.

2-[(5-Methyl[1,2,4]triazolo[1,5-a]pyrimidin-2-yl)sulfanyl]-2′-[(4-nitrophenyl)methylidene]acetohy-drazide (**2-12**). Yield 73%. Yellowy solid. M.p. 250–251°. ^{1}H-NMR: 11.94, 12.06 (2*s*, NH); 9.13 (*d*, *J* = 6.9, CH); 8.15, 8.35 (2*s*, CH); 7.96–8.30 (*m*, 4 arom. H); 7.20 (*d*, *J* = 6.9, CH); 4.17, 4.58 (2*s*, CH_2S); 2.60 (*s*, Me). EI-MS: 371.1 (M^+). Anal. calc. for $C_{15}H_{13}N_7O_3S$ (371.37): C 48.51, H 3.53, N 26.40; found: C 48.69, H 3.19, N 26.22.

2′-[(4-Methoxyphenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-a]pyrimidin-2-yl)sulfanyl]ace-tohydrazide (**2-13**). Yield 84%. White solid. M.p. 198–201°. ^{1}H-NMR: 11.53, 11.63 (2*s*, NH); 9.13 (*d*, *J* = 6.9, CH); 7.99, 8.18 (2*s*, CH); 6.99–7.65 (*m*, 4 arom. H); 7.20 (*d*, *J* = 6.9, CH); 4.17, 4.58 (2*s*, CH_2S); 3.81 (*s*, MeO); 2.61 (*s*, Me). EI-MS: 356.1 (M^+). Anal. calc. for $C_{16}H_{16}N_6O_2S$ (356.40): C 53.92, H 4.52, N 23.58; found: C 54.14, H 4.79, N 23.19.

*2′-[(4-Hydroxy-3-methoxyphenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)-sulfanyl]acetohydrazide* (**2-14**). Yield 88%. White solid. M.p. 154–157°. ^{1}H-NMR: 11.49, 11.59 (2*s*, NH); 9.53 (*s*, OH); 9.10 (*d*, *J* = 5.7, CH); 7.89, 8.04 (2*s*, CH); 7.06–7.24 (*m*, 3 arom. H); 6.79 (*d*, *J* = 5.7, CH); 4.09, 4.50 (2*s*, CH_2S); 3.79 (*s*, MeO); 2.57 (*s*, Me). EI-MS: 372.8 (M^+). Anal. calc. for $C_{16}H_{16}N_6O_3S$ (372.40): C 51.60, H 4.33, N 22.57; found: C 51.31, H 4.05, N 22.82.

*2′-[(4-Hydroxyphenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]acetohydrazide* (**2-15**). Yield 82%. Yellowy solid. M.p. 237–239°. ^{1}H-NMR: 11.45, 11.55 (2*s*, NH); 9.89 (*s*, OH); 9.15 (*d*, *J* = 6.9, CH); 7.89, 8.04 (2*s*, CH); 7.19 (*d*, *J* = 6.9, CH); 6.81–7.54 (*m*, 4 arom. H); 4.11, 4.52 (2*s*, CH_2S); 2.61 (*s*, Me). EI-MS: 342.2 (M^+). Anal. calc. for $C_{15}H_{14}N_6O_2S$ (342.38): C 52.62, H 4.12, N 24.55; found: C 52.89, H 3.97, N 24.32.

*2′-[(2,4-Dihydroxyphenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-acetohydrazide* (**2-16**). Yield 80%. Yellowy solid. M.p. 236–237°. ^{1}H-NMR: 11.77 (*s*, OH); 11.16, 11.39 (2*s*, NH); 9.92 (*s*, OH); 9.11 (*d*, *J* = 6.3, CH); 8.21, 8.30 (2*s*, CH); 7.18 (*d*, *J* = 6.3, CH); 6.30–7.47 (*m*, 3 arom. H); 4.12, 4.49 (2*s*, CH_2S); 2.60 (*s*, Me). EI-MS: 358.5 (M^+). Anal. calc. for $C_{15}H_{14}N_6O_3S$ (358.38): C 50.27, H 3.94, N 23.45; found: C 49.98, H 4.09, N 23.70.

*2′-[(2-Hydroxyphenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]acetohydrazide* (**2-17**). Yield 73%. Yellowy solid. M.p. 222–225°. ^{1}H-NMR: 11.61, 11.99 (2*s*, NH); 10.07 (*s*, OH); 9.12 (*d*, *J* = 6.6, CH); 8.36, 8.46 (2*s*, CH); 7.20 (*d*, *J* = 6.6, CH); 6.84–7.71 (*m*, 4 arom. H); 4.17, 4.55 (2*s*, CH_2S); 2.61 (*s*, Me). EI-MS: 341.9 (M^+). Anal. calc. for $C_{15}H_{14}N_6O_2S$ (342.38): C 52.62, H 4.12, N 24.55; found: C 52.36, H 4.50, N 24.80.

*2′-{[4-(Dimethylamino)phenyl]methylidene}-2-[(5-methyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]acetohydrazide* (**2-18**). Yield 86%. Yellowy solid. M.p. 107–110°. ^{1}H-NMR: 9.26, 10.71 (2*s*, NH); 8.58 (*d*, *J* = 6.9, CH); 7.66, 7.96 (2*s*, CH); 6.62–7.61 (*m*, 4 arom. H); 6.90 (*d*, *J* = 6.9, CH); 3.96, 4.59 (2*s*, CH_2S); 3.01 (*s*, Me_2N); 2.73 (*s*, Me). EI-MS: 369.3 (M^+). Anal. calc. for $C_{17}H_{19}N_7OS$ (369.44): C 55.27, H 5.18, N 26.54; found: C 55.01, H 4.96, N 26.81.

*2′-[(4-Methylphenyl)methylidene]-2-[(5-methyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]aceto-hydrazide* (**2-19**). Yield 87%. White solid. M.p. 196–198°. ^{1}H-NMR: 11.59, 11.70 (2*s*, NH); 9.14 (*d*, *J* = 7.2, CH); 8.02, 8.20 (2*s*, CH); 7.21–7.61 (*m*, 4 arom. H); 7.19 (*d*, *J* = 7.2, CH); 4.14, 4.54 (2*s*, CH_2S); 2.61 (*s*, Me); 2.35 (*s*, *Me*C_6H_4). EI-MS: 340.2 (M^+). Anal. calc. for $C_{16}H_{16}N_6OS$ (340.40): C 56.45, H 4.74, N 24.69; found: C 56.23, H 5.00, N 24.45.

*2-[(5-Methyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-2′-(phenylmethylidene)acetohydrazide* (**2-20**). Yield 77%. White solid. M.p. 186–188°. ^{1}H-NMR: 11.63, 11.74 (2*s*, NH); 9.12 (*d*, *J* = 6.6, CH); 8.04, 8.22 (2*s*, CH); 7.42–7.68 (*m*, 5 arom. H); 7.18 (*d*, *J* = 6.6, CH); 4.13, 4.54 (2*s*, CH_2S); 2.60 (*s*, Me). EI-MS: 326.5 (M^+). Anal. calc. for $C_{15}H_{14}N_6OS$ (326.38): C 55.20, H 4.32, N 25.75; found: C 49.96, H 4.09, N 25.86.

*2′-[(4-Chlorophenyl)methylidene]-2-[(5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-propanohydrazide* (**2-21**). Yield 83%. White solid. M.p. 167–169, ^{1}H-NMR: 11.66, 11.93 (2*s*, NH); 8.01, 8.23 (2*s*, CH); 7.41–7.74 (*m*, 4 arom. H); 7.11, 7.14 (2*s*, 6-CH); 4.63, 5.49 (2*q*, *J* = 6.8, CHS); 2.63, 2.68 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 1.64 (*d*, *J* = 7.6, Me). EI-MS: 389.1 (M^+). Anal. calc. for: $C_{17}H_{17}ClN_6OS$ (388.87): C 52.51, H 4.41, N 21.61; found: C 52.16, H 4.56, N 21.89.

*2′-[(3-Chlorophenyl)methylidene]-2-[(5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-propanohydrazide* (**2-22**). Yield 87%. White solid. M.p. 159–161°. ^{1}H-NMR: 11.45 (*s*, NH); 8.10 (*s*, CH); 7.22–7.80 (*m*, 4 arom. H); 6.84 (*s*, H–C(6)); 4.47 (*q*, *J* = 7.5, CHS); 2.76 (*s*, Me–C(7)); 2.71 (*s*, Me–C(5)); 1.71 (*d*, *J* = 7.5, Me). EI-MS: 388.9 (M^+). Anal. calc. for $C_{17}H_{17}ClN_6OS$ (388.87): C 52.51, H 4.41, N 21.61; found: C 52.65, H 4.68, N 21.24.

*2′-[(2-Chlorophenyl)methylidene]-2-[(5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-propanohydrazide* (**2-23**). Yield 81%. White solid. M.p. 196–198°. ^{1}H-NMR: 11.52 (*s*, NH); 8.52 (*s*, CH); 7.20–8.13 (*m*, 4 arom. H); 6.81 (*s*, H–C(6)); 4.47 (*q*, *J* = 7.5, CHS); 2.75 (*s*, Me–C(7)); 2.70 (*s*, Me–C(5)); 1.71 (*d*, *J* = 7.2, Me). EI-MS: 388.6 (M^+). Anal. calc. for $C_{17}H_{17}ClN_6OS$ (388.87): C 52.51, H 4.41, N 21.61; found: C 52.45, H 4.58, N 21.78.

*2′-[(3,4-Dichlorophenyl)methylidene]-2-[(5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]propanohydrazide* (**2-24**). Yield 87%. White solid. M.p. 189–191°. ^{1}H-NMR: 11.77, 12.05 (2*s*, NH); 7.98, 8.21 (2*s*, CH); 7.59–7.94 (*m*, 3 arom. H); 7.11, 7.14 (2*s*, H–C(6)); 4.64, 5.49 (2*q*, *J* = 6.8, CHS); 2.64,

2.68 (2*s*, Me–C(7)); 2.55 (*s*, Me–C(5)); 1.64 (*d*, *J* = 6.8, Me). EI-MS: 423.5 (M^+). Anal. calc. for $C_{17}H_{16}Cl_2N_6OS$ (423.32): C 48.23, H 3.81, N 19.85; found: C 48.01, H 4.08, N 19.56.

*2′-[(2-Chloro-6-fluorophenyl)methylidene]-2-[(5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]propanohydrazide* (**2-25**). Yield 89%. White solid. M.p. 230–232°. ^{1}H-NMR: 11.82, 12.10 (2*s*, NH); 8.29, 8.49 (2*s*, CH); 7.29–7.49 (*m*, 3 arom. H); 7.08, 7.14 (2*s*, H–C(6)); 4.62, 5.43 (2*q*, *J* = 6.8, CHS); 2.64, 2.69 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 1.65 (*d*, *J* = 6.8, Me). EI-MS: 407.2 (M^+). Anal. calc. for $C_{17}H_{16}ClFN_6OS$ (406.86): C 50.18, H 3.96, N 20.66; found: C 50.32, H 4.09, N 20.39.

*2-[(5,7-Dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-2′-[(2-fluorophenyl)methylidene]propanohydrazide* (**2-26**). Yield 78%. White solid. M.p. 181–183°. ^{1}H-NMR: 11.71, 12.00 (2*s*, NH); 8.23, 8.46 (2*s*, CH); 7.12–7.88 (*m*, 4 arom. H); 7.11, 7.14 (2*s*, H–C(6)); 4.60, 5.51 (2*q*, *J* = 6.8, CHS); 2.64, 2.68 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 1.65 (*d*, *J* = 7.6, Me). EI-MS: 372.7 (M^+). Anal. calc. for $C_{17}H_{17}FN_6OS$ (372.42): C 54.83, H 4.60, N 22.57; found: C 54.68, H 4.43, N 22.36.

*2-[(5,7-Dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-2′-[(3-fluorophenyl)methylidene]propanohydrazide* (**2-27**). Yield 74%. White solid. M.p. 153–155°. ^{1}H-NMR: 11.71, 11.98 (2*s*, NH); 8.01, 8.25 (2*s*, CH); 7.12–7.56 (*m*, 4 arom. H); 7.10, 7.13 (2*s*, H–C(6)); 4.65, 5.54 (2*q*, *J* = 6.8, CHS); 2.65, 2.68 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 1.66 (*d*, *J* = 7.2, Me). EI-MS: 372.1 (M^+). Anal. calc. for $C_{17}H_{17}FN_6OS$ (372.42): C 54.83, H 4.60, N 22.57; found: C 55.02, H 4.87, N 22.29.

*2-[(5,7-Dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-2′-[(2-nitrophenyl)methylidene]propanohydrazide* (**2-28**). Yield 84%. Yellowy solid. M.p. 223–224°. ^{1}H-NMR: 11.88, 12.21 (2*s*, NH); 8.42, 8.66 (2*s*, CH); 7.62–8.10 (*m*, 4 arom. H); 7.09, 7.14 (2*s*, H–C(6)); 4.63, 5.48 (2*q*, *J* = 6.8, CHS); 2.62, 2.69 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 1.64 (*d*, *J* = 7.2, Me). EI-MS: 399.8 (M^+). Anal. calc. for $C_{17}H_{17}N_7O_3S$ (399.43): C 51.12, H 4.29, N 24.55; found: C 52.39, H 4.51, N 24.19.

*2-[(5,7-Dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-2′-[(3-nitrophenyl)methylidene]propanohydrazide* (**2-29**). Yield 81%. Yellowy solid. M.p. 213–214°. ^{1}H-NMR: 11.85, 12.12 (2*s*, NH); 8.37, 8.53 (2*s*, CH); 7.63–8.40 (*m*, 4 arom. H); 7.10, 7.14 (2*s*, H–C(6)); 4.67, 5.53 (2*q*, *J* = 7.2, CHS); 2.64, 2.69 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 1.67 (*d*, *J* = 7.2, Me). EI-MS: 399.1 (M^+). Anal. calc. for $C_{17}H_{17}N_7O_3S$ (399.43): C 51.12, H 4.29, N 24.55; found: C 51.35, H 4.58, N 24.24.

*2-[(5,7-Dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-2′-[(4-nitrophenyl)methylidene]propanohydrazide* (**2-30**). Yield 87%. Yellowy solid. M.p. 200–201°. ^{1}H-NMR: 11.90, 12.16 (2*s*, NH); 8.11, 8.35 (2*s*, CH); 7.87–8.31 (*m*, 4 arom. H); 7.11, 7.14 (2*s*, H–C(6)); 4.65, 5.54 (2*q*, *J* = 6.8, CHS); 2.62, 2.68 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 1.65 (*d*, *J* = 7.2, Me). EI-MS: 399.0 (M^+). Anal. calc. for $C_{17}H_{17}N_7O_3S$ (399.43): C 51.12, H 4.29, N 24.55; found: C 50.96, H 4.60, N 24.82.

*2-[(5,7-Dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-2′-[(2-hydroxy-4-methoxyphenyl)methylidene]propanohydrazide* (**2-31**). Yield 57%. Yellowy solid. M.p. 184–186°. ^{1}H-NMR: 11.42, 11.96 (2*s*, NH); 10.14, 11.28 (2*s*, OH); 8.23, 8.36 (2*s*, CH); 6.41–7.48 (*m*, 3 arom. H); 7.11, 7.14 (2*s*, H–C(6)); 4.61, 5.41 (2*q*, *J* = 7.2, CHS); 3.73, 3.77 (2*s*, MeO); 2.65, 2.68 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 1.65 (*d*, *J* = 7.2, Me). EI-MS: 400.5 (M^+). Anal. calc. for $C_{18}H_{20}N_6O_3S$ (400.45): C 53.99, H 5.03, N 20.99; found: C 54.13, H 4.86, N 21.23.

*2′-[(2-Hydroxy-5-methoxyphenyl)methylidene]-2-[(5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]propanohydrazide* (**2-32**). Yield 66%. Yellowy solid. M.p. 212–213°. ^{1}H-NMR: 11.55, 12.04 (2*s*, NH); 9.58, 10.39 (2*s*, OH); 8.29, 8.44 (2*s*, CH); 6.80–7.13 (*m*, 3 arom. H); 7.10, 7.14 (2*s*, H–C(6)); 4.62, 5.43 (2*q*, *J* = 7.2, CHS); 3.58, 3.72 (2*s*, MeO); 2.65, 2.68 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 1.65 (*d*, *J* = 7.2, Me). EI-MS: 400.3 (M^+). Anal. calc. for $C_{18}H_{20}N_6O_3S$ (400.45): C 53.99, H 5.03, N 20.99; found: C 53.78, H 5.31, N 20.86.

*2′-[(5-Bromo-2-hydroxyphenyl)methylidene]-2-[(5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]propanohydrazide* (**2-33**). Yield 66%. White solid. M.p. 230–232°. ^{1}H-NMR: 11.61, 12.14 (2*s*, NH); 10.37, 11.03 (2*s*, OH); 8.25, 8.42 (2*s*, CH); 6.82–7.77 (*m*, 3 arom. H); 7.10, 7.14 (2*s*, H–C(6)); 4.61, 5.47 (2*q*, *J* = 6.8, CHS); 2.66, 2.68 (2*s*, Me–C(7)); 2.55, 2.56 (2*s*, Me–C(5)); 1.64 (*d*, *J* = 7.2, Me). EI-MS: 449.6 (M^+). Anal. calc. for $C_{17}H_{17}BrN_6O_2S$ (449.32): C 45.44, H 3.81, N 18.70; found: C 45.23, H 3.90, N 18.67.

*2′-[(5-Chloro-2-hydroxyphenyl)methylidene]-2-[(5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]propanohydrazide* (**2-34**). Yield 77%. White solid. M.p. 216–217°. ^{1}H-NMR: 11.61, 12.14 (2*s*, NH); 10.34, 11.01 (2*s*, OH); 8.25, 8.42 (2*s*, CH); 6.86–7.64 (*m*, 3 arom. H); 7.11, 7.14 (2*s*, H–C(6)); 4.61,

5.48 (2*q*, *J* = 7.2, CHS); 2.66, 2.68 (2*s*, Me–C(7)); 2.54, 2.56 (2*s*, Me–C(5)); 1.64 (*d*, *J* = 7.2, Me). EI-MS: 404.6 (M^+). Anal. calc. for $C_{17}H_{17}ClN_6O_2S$ (404.87): C 50.43, H 4.23, N 20.76; found: C 50.27, H 4.10, N 20.57.

*2-[(5,7-Dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-2′-[(4-methoxyphenyl)methylidene]-propanohydrazide* (**2-35**). Yield 74%. White solid. M.p.169–171°. ^{1}H-NMR: 11.48, 11.73 (2*s*, NH); 7.97, 8.18 (2*s*, CH); 6.90–7.65 (*m*, 4 arom. H); 7.11, 7.13 (2*s*, H–C(6)); 4.62, 5.51 (2*q*, *J* = 6.0, CHS); 3.78, 3.81 (2*s*, MeO); 2.65, 2.68 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 1.65 (*d*, *J* = 5.6, Me). EI-MS: 384.3 (M^+). Anal. calc. for $C_{18}H_{20}N_6O_2S$ (384.46): C 56.23, H 5.24, N 21.86; found: C 56.46, H 5.48, N 21.58.

*2-[(5,7-Dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-2′-[(4-methylphenyl)methylidene]-propanohydrazide* (**2-36**). Yield 72%. White solid. M.p. 190–192°. ^{1}H-NMR: 11.53, 11.79 (2*s*, NH); 7.98, 8.19 (2*s*, CH); 7.16–7.60 (*m*, 4 arom. H); 7.11, 7.14 (2*s*, H–C(6)); 4.62, 5.51 (2*q*, *J* = 6.8, CHS); 2.64, 2.68 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 2.31, 2.38 (2*s*, Me); 1.65 (*d*, *J* = 6.8, Me). EI-MS: 368.2 (M^+). Anal. calc. for $C_{18}H_{20}N_6OS$ (368.46): C 58.68, H 5.47, N 22.81; found: C 58.96, H 5.23, N 22.97.

*2-[(5,7-Dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-2′-[(4-hydroxyphenyl)methylidene]-propanohydrazide* (**2-37**). Yield 75%. White solid. M.p. 158–159°. ^{1}H-NMR: 11.40, 11.66 (2*s*, NH); 9.90, 9.95 (2*s*, OH); 7.92, 8.12 (2*s*, CH); 6.73–7.53 (*m*, 4 arom. H); 7.11, 7.14 (2*s*, H–C(6)); 4.61, 5.49 (2*q*, *J* = 6.8, CHS); 2.65, 2.68 (2*s*, Me–C(7)); 2.57 (*s*, Me–C(5)); 1.64 (*d*, *J* = 6.4, Me). EI-MS: 370.5 (M^+). Anal. calc. for $C_{17}H_{18}N_6O_2S$ (370.43): C 55.12, H 4.90, N 22.69; found: C 55.23, H 4.76, N 22.57.

*2′-{[4-(Dimethylamino)phenyl]methylidene}-2-[(5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)-sulfanyl]propanohydrazide* (**2-38**). Yield 71%. Yellow solid. M.p. 129–131°. ^{1}H-NMR: 11.31, 11.55 (2*s*, NH); 7.88, 8.07 (2*s*, CH); 7.63–7.51 (*m*, 4 arom. H); 7.11, 7.13 (2*s*, H–C(6)); 4.60, 5.49 (2*q*, *J* = 6.8, CHS); 2.95, 2.97 (2*s*, Me_2N); 2.64, 2.68 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 1.64 (*d*, *J* = 6.4, Me). EI-MS: 397.3 (M^+). Anal. calc. for $C_{19}H_{23}N_7OS$ (397.50): C 57.41, H 5.83, N 24.67; found: C 57.56, H 5.71, N 24.29.

*2-[(5,7-Dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-2′-[(4-hydroxy-3-methoxyphenyl)methylidene]propanohydrazide* (**2-39**). Yield 73%. White solid. M.p. 147–149°. ^{1}H-NMR: 11.43, 11.66 (2*s*, NH); 9.48, 9.55 (2*s*, OH); 7.89, 8.10 (2*s*, CH); 6.73–7.26 (*m*, 3 arom. H); 7.10, 7.14 (2*s*, H–C(6)); 4.60, 5.41 (2*q*, *J* = 6.8, CHS); 3.70, 3.81 (2*s*, MeO); 2.65, 2.68 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 1.64 (*d*, *J* = 6.8, Me). EI-MS: 400.1 (M^+). Anal. calc. for $C_{18}H_{20}N_6O_3S$ (400.45): C 53.99, H 5.03, N 20.99; found: C 54.24, H 5.14, N 20.65.

*2-[(5,7-Dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)sulfanyl]-2′-(phenylmethylidene)propanohydrazide* (**2-40**). Yield 74%. White solid. M.p. 190–191°. ^{1}H-NMR: 11.62, 11.87 (2*s*, NH); 8.03, 8.25 (2*s*, CH); 7.34–7.71 (*m*, 5 arom. H); 7.10, 7.12 (2*s*, H–C(6)); 4.65, 5.53 (2*q*, *J* = 6.8, CHS); 2.64, 2.68 (2*s*, Me–C(7)); 2.56 (*s*, Me–C(5)); 1.66 (*d*, *J* = 6.8, Me). EI-MS: 354.3 (M^+). Anal. calc. for $C_{17}H_{18}N_6OS$ (354.43): C 57.61, H 5.12, N 23.71; found: C 57.35, H 5.24, N 23.58.

*2-[(6-Chloro-5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)oxy]-2′-[(2-chlorophenyl)methylidene]acetohydrazide* (**3-1**). Yield 85%. White solid. M.p. 237–239°. ^{1}H-NMR: 11.86, 12.02 (2*s*, NH); 8.41, 8.68 (2*s*, CH); 7.42–8.01 (*m*, 4 arom. H); 5.01, 5.48 (2*s*, CH_2O); 2.77, 2.78 (2*s*, Me–C(7)); 2.62 (*s*, Me–C(5)). EI-MS: 393.1 (M^+). Anal. calc. for $C_{16}H_{14}Cl_2N_6O_2$ (393.23): C 48.87, H 3.59, N 21.37; found: C 49.10, H 3.68, N 21.18.

*2-[(6-Chloro-5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)oxy]-2′-[(4-chlorophenyl)methylidene]acetohydrazide* (**3-2**). Yield 86%. White solid. M.p. 235–237°. ^{1}H-NMR: 11.73, 11.81 (2*s*, NH); 8.02, 8.27 (2*s*, CH); 7.50–7.75 (*m*, 4 arom. H); 5.00, 5.46 (2*s*, CH_2O); 2.77 (*s*, Me–C(7)); 2.63 (*s*, Me–C(5)). EI-MS: 393.4 (M^+). Anal. calc. for $C_{16}H_{14}C_{12}N_6O_2$ (393.23): C 48.87, H 3.59, N 21.37; found: C 48.75, H 3.76, N 21.68.

*2-[(6-Chloro-5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)oxy]-2′-[(3-fluorophenyl)methylidene]acetohydrazide* (**3-3**). Yield 84%. White solid. M.p. 239–240°. ^{1}H-NMR: 11.77, 11.86 (2*s*, NH); 8.02, 8.28 (2*s*, CH); 7.27–7.58 (*m*, 4 arom. H); 5.01, 5.47 (2*s*, CH_2O); 2.77, 2.78 (2*s*, Me–C(7)); 2.63 (*s*, Me–C(5)). EI-MS: 377.1 (M^+). Anal. calc. for $C_{16}H_{14}ClFN_6O_2$ (376.77): C 51.00, H 3.75, N 22.31; found: C 50.86, H 4.02, N 22.14.

*2-[(6-Chloro-5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)oxy]-2′-[(4-fluorophenyl)methylidene]acetohydrazide* (**3-4**). Yield 87%. White solid. M.p. 227–229°. ^{1}H-NMR: 11.68, 11.76 (2*s*, NH); 8.02, 8.28 (2*s*, CH); 7.27–7.80 (*m*, 4 arom. H); 5.00, 5.45 (2*s*, CH_2O); 2.77, 2.78 (2*s*, Me–C(7)); 2.62 (*s*,

Me–C(5)). EI-MS: 376.9 (M^+). Anal. calc. for $C_{16}H_{14}ClFN_6O_2$ (376.77): C 51.00, H 3.75, N 22.31; found: C 51.13, H 3.89, N 22.17.

*2-[(6-Chloro-5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)oxy]-2′-[(4-methylphenyl)methylidene]acetohydrazide* (**3-5**). Yield 75%. White solid. M.p. 226–228°. ^{1}H-NMR: 11.62, 11.71 (2*s*, NH); 7.99, 8.22 (2*s*, CH); 7.25–7.61 (*m*, 4 arom. H); 4.99, 5.44 (2*s*, CH_2O); 2.77, 2.78 (2*s*, Me–C(7)); 2.62 (*s*, Me–C(5)); 2.34 (*s*, Me). EI-MS: 372.9 (M^+). Anal. calc. for $C_{17}H_{17}ClN_6O_2$ (372.81): C 54.77, H 4.60, N 22.54; found: C 54.89, H 4.45, N 22.75.

*2-[(6-Chloro-5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)oxy]-2′-[(4-methoxyphenyl)methylidene]acetohydrazide* (**3-6**). Yield 78%. White solid. M.p. 209–211°. ^{1}H-NMR: 11.54, 11.63 (2*s*, NH); 7.96, 8.21 (2*s*, CH); 6.99–7.66 (*m*, 4 arom. H); 4.98, 5.43 (2*s*, CH_2O); 3.80 (*s*, MeO); 2.77, 2.78 (2*s*, Me–C(7)); 2.62 (*s*, Me–C(5)). EI-MS: 388.6 (M^+). Anal. calc. for $C_{17}H_{17}ClN_6O_3$ (388.81): C 52.51, H 4.41, N 21.61; found: C 52.76, H 4.57, N 21.28.

*2-[(6-Chloro-5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)oxy]-2′-[(2-hydroxy-4-methoxyphenyl)methylidene]acetohydrazide* (**3-7**). Yield 65%. White solid. M.p. 244–246°. ^{1}H-NMR: 11.46, 11.87 (2*s*, NH); 10.16, 11.30 (2*s*, OH); 7.95, 8.40 (2*s*, CH); 6.45–8.23 (*m*, 3 arom. H); 5.00, 5.40 (2*s*, CH_2O); 3.75, 3.76 (2*s*, MeO); 2.77, 2.78 (2*s*, Me–C(7)); 2.62 (*s*, Me–C(5)). EI-MS: 405.1 (M^+). Anal. calc. for $C_{17}H_{17}ClN_6O_4$ (404.81): C 50.44, H 4.23, N 20.76; found: C 50.70, H 4.01, N 20.96.

*2-[(6-Chloro-5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)oxy]-2′-[(2-hydroxy-5-methoxyphenyl)methylidene]acetohydrazide* (**3-8**). Yield 60%. White solid. M.p. 249–251°. ^{1}H-NMR: 11.59, 11.96 (2*s*, NH); 9.62, 10.41 (2*s*, OH); 7.95, 8.47 (2*s*, CH); 6.83–8.29 (*m*, 3 arom. H); 5.01, 5.40 (2*s*, CH_2O); 3.71 (*s*, MeO); 2.77, 2.78 (2*s*, Me–C(7)); 2.63 (*s*, Me–C(5)). EI-MS: 404.6 (M^+). Anal. calc. for $C_{17}H_{17}ClN_6O_4$ (404.81): C 50.44, H 4.23, N 20.76; found: C 50.65, H 4.51, N 20.85.

*2′-[(5-Bromo-2-hydroxyphenyl)methylidene]-2-[(6-chloro-5,7-dimethyl[1,2,4]triazolo[1,5-*a*]pyrimidin-2-yl)oxy]acetohydrazide* (**3-9**). Yield 76%. White solid. M.p. 265–267°. ^{1}H-NMR: 11.66, 12.06 (2*s*, NH); 10.41, 11.05 (2*s*, OH); 7.83, 8.46 (2*s*, CH); 6.87–8.26 (*m*, 3 arom. H); 5.02, 5.45 (2*s*, CH_2O); 2.77, 2.78 (2*s*, Me–C(7)); 2.63 (*s*, Me–C(5)). EI-MS: 454.1 (M^+). Anal. calc. for $C_{16}H_{14}BrClN_6O_3$ (453.68): C 42.36, H 3.11, N 18.52; found: C 42.14, H 2.98, N 18.75.

X-Ray Crystal Structure of **2-3**. Crystals of **2-3** were grown by slow evaporation of a DMF/EtOH soln. at r.t. Colorless blocks of **2-3** ($0.30 \times 0.20 \times 0.10$ mm) were mounted on a quartz fiber with protection oil. Cell dimensions and intensities were measured at 298 ± 2 K on a *Bruker SMART CCD* area detector diffractometer with graphite-monochromated MoK_α radiation (λ 0.71073 Å). *Crystal data for* **2-3**: $C_{15}H_{13}ClN_6OS$, M_r 360.82, monoclinic, space group $C2/c$; $a = 17.602(4)$, $b = 15.423(3)$, $c = 13.818(3)$ Å; $\beta = 119.06\,(4)^\circ$, $V = 3278.9(12)$ Å^3, $Z = 8$, $D_{calc.} = 1.462$ g/cm^3. A total of 3885 reflections were measured in the range of $1.87^\circ \leq \theta \leq 25.09^\circ$; 2729 independent reflections ($R_{int} = 0.0152$). Data were corrected for *Lorentz* and polarization effects and for absorption ($T_{min} = 0.8956$; $T_{max} = 0.9634$). The structure was solved by direct methods using SHELXS-97 and refined using SHELXS-97; all other calculations were performed with *Bruker* SMART system and *Bruker* SMART programs [16–19]. Full-matrix least-squares refinement based on F^2 using the weight of $1/[\sigma^2(F_o^2) + (0.1013P)^2 + 0.8599P]$ ($P = (F_o^2 + 2F_c^2)/3$) gave final values of $R = 0.0468$, $\omega R = 0.1655$, and GOF(F) = 1.083 for 218 variables and 2729 contributing reflections. Maximum shift/error 0.000, max/min residual electron density 0.297/−0.306 e Å^{-3}. All H-atoms bonded to C-atoms were positioned geometrically, with C–H = 0.93, 0.97, and 0.96 Å for arom. H-atoms, CH_2, and Me groups, resp., and their displacement parameters were set 1.2 times that of their carried atoms. H(2a) was found from the difference map and refined with a distance restraint of N–H = 0.86(1) Å, $U_{iso}(H) = 1.2U_{eq}(N)$. The crystallographic data of **2-3** have been deposited with the *Cambridge Crystallographic Data Centre* with the deposition No. CCDC-665799. Copies of the data can be obtained free of charge *via* http://www.ccdc.cam.ac.uk/data request/cif.

Bioassays of Fungicidal Activities. The fungicidal activities were tested according to our previous methods [12][14][15]. The tested samples were dissolved in 0.5 ml of DMF at a concentration of 500 mg/l. The solns. (1 ml) were mixed rapidly with thawed potato glucose agar culture medium (9 ml) at 50°. The mixtures were poured into *Petri* dishes. After the dishes were cooled, the solidified plates were incubated with 4-mm mycelium disks, inverted, and incubated at 28° for 48 h. The mixed medium without sample was used as the blank control. Three replicates of each test were carried out. The mycelial elongation radius (mm) of fungi settlements was measured after 48 h of culture. The growth inhibition

rates were calculated with the following equation: $I=[(C-T)/C]\times 100\%$, where I is the growth inhibition rate [%], C is the control settlement radius (mm), and T is the treatment group fungi settlement radius (mm). From a concentration–inhibition ranking relationship, the concentration to give 50% inhibition effect was defined as EC_{50} [20].

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