Synthesis and Fungicidal Activities of Novel 1,2,4-Triazole Thione Derivatives Containing 1,2,3-Triazole and Substituted Piperazine Moieties

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**Supplemental Materials**

***Bioligical Activities***

**Table S 1**: The fungicidal activities of tested Compounds at 50 μg/mL

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Compd. | *Alternaria solani Sorauer* | Gibberella sanbinetti | Fusarium omysporum | *Cercospora arachidicola* | *Physalospora piricola* | *Rhizoctonia cerealis* |
| **8a** | 26.3 | 24.4 | 0.0 | 20.0 | 48.8 | 33.9 |
| **8b** | 36.8 | 26.8 | 29.0 | 30.0 | 44.2 | 48.2 |
| **8c** | 42.1 | 46.3 | 38.7 | 55.0 | 69.8 | 89.3 |
| **8d** | 36.8 | 19.5 | 41.9 | 30.0 | 55.8 | 78.6 |
| **9a** | 31.6 | 31.7 | 22.6 | 35.0 | 51.2 | 39.3 |
| **9b** | 21.1 | 34.1 | 19.4 | 20.0 | 39.5 | 21.4 |
| **9c** | 31.6 | 19.5 | 41.9 | 25.0 | 32.6 | 44.6 |
| **9d** | 26.3 | 14.6 | 35.5 | 50.0 | 72.1 | 64.3 |
| **9e** | 60.0 | 68.4 | 7.4 | 23.8 | 42.6 | 89.8 |
| **9f** | 46.7 | 63.2 | 11.1 | 23.8 | 57.4 | 85.7 |
| **9g** | 42.1 | 68.3 | 38.7 | 70.0 | 65.1 | 89.3 |
| **9h** | 52.6 | 36.6 | 22.6 | 65.0 | 30.2 | 78.6 |
| **10a** | 10.5 | 24.4 | 45.2 | 35.0 | 72.1 | 51.8 |
| **10b** | 15.8 | 26.8 | 58.1 | 30.0 | 88.4 | 55.4 |
| Triadimefon | 31.3 | 52.9 | 63.6 | 66.7 | 71.4 | 98.0 |
| Carbendazim | 100 |  |  | 100 |  |  |
| Chlorothalonil |  | 72.2 | 75 |  | 100 |  |

*2-((4-Benzylpiperazin-1-yl)methyl)-4-(((2-phenyl-2H-1,2,3-triazol-4-yl)methylene)amino)-5-(trifluoromethyl)-2,4-dihydro-3H-1,2,4-triazole-3-thione (****8c****)*

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**Figure S 1**: The 1H NMR spectrum of compound **8c**.



**Figure S 2**: The 13C NMR spectrum of compound **8c**.

*2-((4-(4,6-Dimethylpyrimidin-2-yl)piperazin-1-yl)methyl)-5-methyl-4-(((2-phenyl-2H-1,2,3-triazol-4-yl)methylene)amino)-2,4-dihydro-3H-1,2,4-triazole-3-thione (****9d****)*

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**Figure S 3**: The 1H NMR spectrum of compound **9d**.



**Figure S 4**: The 13C NMR spectrum of compound **9d**.