Scientific paper

Synthesis of Novel Linked Pyrazolyl-thiazolidinone Heterocycles as Potent Antibacterial Agents

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Abstract

A novel series of 2-(3,5-dimethyl-1-phenyl-1*H*-4-pyrazolyl)-3-(aryl/heteroaryl)-1,3-thiazolidin-4-one derivatives **4a**–**h** has been synthesized readily in one-pot from 3,5-dimethyl-1-phenyl-1*H*-4-pyrazolecarbaldehyde (**3**), and characterized *via* IR, NMR, MS and elemental analyses. Further, these compounds were screened for antibacterial (MIC) activity against *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli* and *Staphylococcus pyogenes.* Amongst them, compounds containing pyridyl **4g** and pyrimidinyl **4h** moiety exerted superior antibacterial activity against *S. aureus* and *E. coli* at the concentration of 6.25 μg/mL, which is less than the concentration of the standards neomycin and streptomycin, and emerged as potential molecules for further development.

Keywords: Thiazolan-4-one, pyrazole, antibacterial activity.

1. Introduction

Heterocyclic compounds represent one of the most active classes of compounds possessing a wide spectrum of biological activities, including antibacterial, antifungal, and other biological activities.[1–6] Pyrazole and its derivatives represent one of the most active classes of compounds possessing a wide spectrum of biological activities such as antidepressant,[7] inhibitors of protein kinases,[8] antiagregating,[9] antiarthritic,[10] cerebroprotectors,[11] antibacterial,[12] antifungal,[13] herbicidal,[14] insecticidal[15] and other biological activities.[16–18] Some aryl pyrazoles were reported to have non-nucleoside HIV-1 reverse transcriptase inhibitory,[19] COX-2 inhibitory activity,[20] activation of the nitric oxide receptor and soluble guanylate cyclase activity.[21] Similarly, there has been a considerable interest in the chemistry of thiazolidin-4-one ring system, which is a core structure in various synthetic pharmaceuticals displaying a broad spectrum of biological activities.[22] Thiazolidin-4-one ring also occurs in nature; thus actithiazic acid isolated from *streptomyces* strains exhibits highly specific *in vitro* activity against *Mycobacterium tuberculosis.*[23] Thiazolidin-4-one derivatives are also known to exhibit diverse bioactivities such as anti-convulsant,[24] antidiarrheal,[25] anti-platelet activating factor,[26] anti-histaminic,[27] anti-diabetic,[28] cyclooxygenase (COX) inhibitory,[29] Ca^{2+}-channel blocker,[30] platelet activating factor (PAF) antagonist,[31] cardioprotective,[32] anti-ischemic,[33] anti-cancer,[34] tumor necrosis factor-*á* antagonist[35] and nematicidal activities.[36] The synthesis of heterocycles containing multi-structure in a molecule has received much attention in recent years.[37] However, literature survey revealed that linked bi-heterocyclics containing pyrazole have seldom been reported.

In view of all these facts and as the continuation of our work on the synthesis of new heterocyclic derivatives,[38–43] it was thought of interest to accommodate pyrazole and thiazolidin-4-one moieties in a single molecular frame work and to obtain new heterocyclic compounds with potential biological activity. In the present study we report the synthesis and antibacterial evaluation of some new 2-(3,5-dimethyl-1-phenyl-1*H*-4-pyrazolyl)-3-(aryl/heteroaryl)-1,3-thiazolan-4-one.

2. Results and Discussion

The β-diketones are excellent starting materials for the synthesis of pyrazole derivatives *via* the reaction of β-diketones **1** with phenylhydrazine under reflux in ethanol. This one-step method for the synthesis of the new 3,5-dimethyl-1-phenyl-1*H*-pyrazole (**2**) is carried out. The method is easy to perform and uses almost all the available starting material to give the product in high yield. Thus, heating an equimolar mixture of ethyl acetoacetate and phenylhydrazine in ethanol afforded 3,5-dimethyl-1-phenyl-1*H*-pyrazole (**2**) in 90% yield (Scheme 1). The elemental analysis and spectroscopic data are consistent with the assigned structure. IR spectrum of **2** exhibited absorption bands at 3010, 1630 and 1610 cm^{-1} due to C–H (aromatic), C=N and C=C of pyrazole ring, respectively. Its ^{1}H NMR spectrum showed signals at δ 7.10–7.20 (m, 5H, *N*-phenyl), 6.21 (s, 1H, pyrazole 4-H), 2.36 (s, 3H, 3-CH_3) and 2.22 (s, 3H, 5-CH_3).

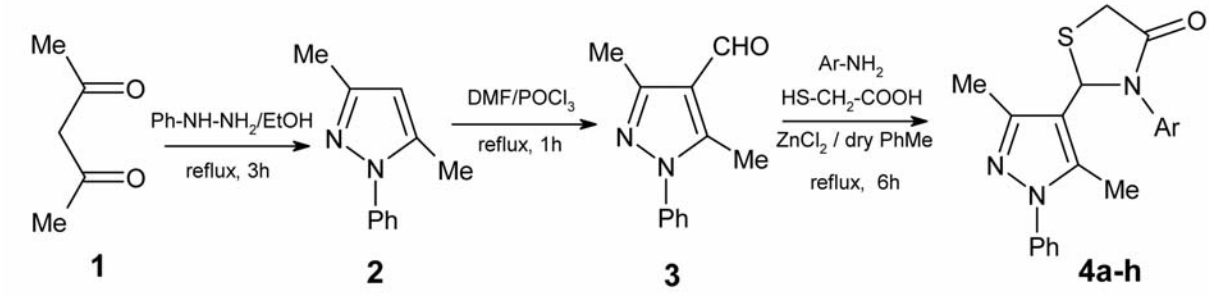
Compound **2** has been utilized as a starting material for the synthesis of 3,5-dimethyl-1-phenyl-1*H*-4-pyrazolecarbaldehyde (**3**), thus compound **2** reacted with *N*,*N*-dimethylformamide (DMF) in the presence of phosphorous oxychloride to afford **3** in 86% yield (Scheme 1). The structure of **3** was confirmed with the elemental and spectroscopic data. The IR spectrum of **3** revealed the appearance of carbonyl (C=O) band at 1700 cm^{-1} and formyl (C–H) band at 2854 cm^{-1}. ^{1}H NMR spectrum of compound **3** showed signals at δ 9.98 (s, 1H, aldehyde proton), 7.25–7.15 (m, 5H, *N*-phenyl), 2.71 (s, 3H, 3-CH_3) and 2.64 (s, 3H, 5-CH_3). Further confirmation for the formation of compound **3** is obtained by the disappearance of the proton signal, corresponding to 4-position of the pyrazole ring.

The one-pot synthesis of 2-(3,5-dimethyl-1-phenyl-1*H*-4-pyrazolyl)-3-(aryl/heteroaryl)-1,3-thiazo-lidin-4-one derivatives **4a**–**h** was carried out by the condensation-cyclization reaction between compound **3**, primary aryl/heteroaryl amine and mercaptoacetic acid in the presence of $ZnCl_2$ using dry toluene as the solvent under reflux for about 6 h (Scheme 1). The compounds, isolated by conventional work-up, were obtained in satisfactory yields. The elemental analyses and spectroscopic data are consistent with the assigned structures.

In the IR spectra of compounds **4a**–**h**, disappearance of aldehyde (O=C–H) absorption band at about 2854 cm^{-1}, which was present in compound **3**, confirmed the formation of thiazolidin-4-one ring by the involvement of the aldehyde group. The absorption bands corresponding to C=N of the pyrazole ring and C=O of thiazolidin-4-one ring were observed at about 1630 and 1710 cm^{-1}, respectively. Further support was obtained from the ^{1}H NMR spectra: the N–CH–S proton and 5-CH_2 protons of thiazolidin-4-one ring appeared as singlets at δ 5.64 and 3.73 ppm, respectively. These signals are further proof of evidence of their structures. The aromatic and aliphatic proton signals were observed at the expected regions. In summary, all the synthesized compounds exhibited satisfactory spectral data consistent with their structures.

3. Antibacterial Evaluation

The target compounds **4a**–**h** were evaluated for their antibacterial activity against four representative organisms *viz. Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli* and *Staphylococcus pyogenes* by the tube dilution method recommended by National Committee for Clinical Laboratory Standards.[44] Bacteria were grown overnight in Luria Bertani (LB) broth at 375 °C, harvested by centrifugation and then washed twice with sterile distilled water. Stock solutions of the series of compounds were prepared in DMSO. Each stock solution was diluted with standard method broth (Difco) to prepare serial two-fold dilutions in the range of 100 to 0.8 μg/mL. Ten microliters of the broth containing about 10^5 colony-forming units (cfu)/mL of test bacteria were added to each well of a 96-well microtiter plate. Culture plates were incubated for 24 h at 37 °C, and the growth of bacteria was monitored visually and spectrophotometrically. Streptomycin and neomycin were also screened under identical conditions for comparison. The minimum inhibitory concentration (MIC, μg/mL, *i.e.* minimum concentration required to inhibit the growth of bacteria) of all the compounds was determined and observed that the compounds exhibited interesting biological activity with a degree of variation (Table 2).



Scheme 1. Synthetic route of 2-(3,5-dimethyl-1-phenyl-1*H*-4-pyrazolyl)-3-(aryl/heteroaryl)-1,3-thiazolidin-4-ones

Table 1. Physical characterization of synthesized compounds **2**–**4**

Product	Ar	Yield (%)	mp (°C)
2	–	90	270–272
3	–	86	124–126
4a	C_6H_5-	64	149–151
4b	4-Cl-C_6H_4-	66	138–140
4c	4-(NO_2)-C_6H_4-	71	143–145
4d	2-(CH_3)-C_6H_4-	68	136–138
4e	4-(CH_3)-C_6H_4-	70	139–141
4f	4-(OH)-C_6H_4-	72	151–153
4g	4-pyridyl	70	161–163
4h	2-pyrimidinyl	68	157–159

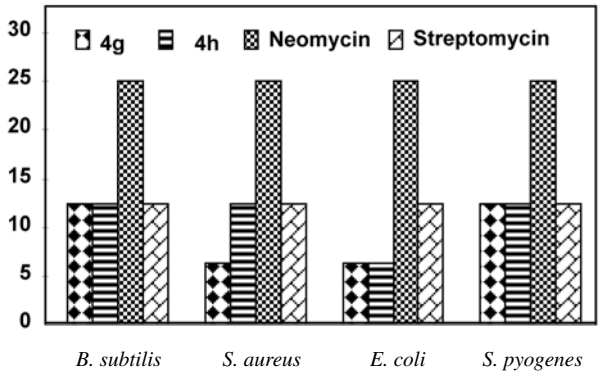


Fig. 1. Comparison of MIC values (μg/mL) of selected compounds and standard drugs

The antibacterial screening data revealed that all the tested compounds **4a–h** are active and showed good antibacterial activity. Compounds, **4b**, **4c**, **4f**, **4g**, and **4h** exhibited potent activity, compared to the standards, against all the microorganisms employed. The presence of 4-chlorophenyl **4b**, 4-nitrophenyl **4c** and 4-hydroxyphenyl **4f** showed significant inhibition, which is more than the neomycin and equal to the streptomycin. Further, the compounds **4g** and **4h** showed excellent antibacterial activity against *S. aureus* and *E. coli* at the concentration less than the neomycin and streptomycin, therefore the presence of pyridyl group on nitrogen of thiazolidinone ring **4g** and the presence of pirimidinyl ring **4h** might be the reason for the significant inhibitory activity. The comparison of MIC values (μg/mL) of the **4g** and **4h** with the standards against different bacteria is presented in Figure 1.

Table 2. Antibacterial activity of compounds **4a**–**h**

	Minimum inhibitory concentration (MIC μg/mL)			
Compound	***B. subtilis***	***S. aureus***	***E. coli***	***S. pyogenes***
4a	50.0	25.0	50.0	50.0
4b	12.5	12.5	25.0	12.5
4c	25.0	25.0	12.5	12.5
4d	25.0	50.0	25.0	25.0
4e	50.0	50.0	50.0	50.0
4f	12.5	12.5	12.5	25.0
4g	12.5	6.25	6.25	12.5
4h	12.5	12.5	6.25	12.5
neomycin	25.0	25.0	25.0	25.0
streptomycin	12.5	12.5	12.5	12.5

4. Experimental

Commercial grade reagents were used as supplied. Solvents except analytical reagent grade were dried and purified according to the literature when necessary. Reaction progress and purity checks of the compounds were made by thin-layer chromatography (TLC) on pre-coated silica gel F_{254} plates from Merck and compounds visualized by exposure to UV light. Silica gel chromatographic columns (70–230 mesh) were used for separations. All the melting points are uncorrected and measured using Fisher–Johns apparatus. IR spectra were recorded as KBr disks on a Perkin–Elmer FTIR spectrometer. The ^{1}H, ^{13}C NMR spectra were recorded on a Varian Gemini spectrometer, operating at 300 and 75 MHz, respectively. Chemical shifts are expressed as ppm (δ values) against tetramethylsilane (TMS) as internal standard and coupling constants (*J*) are reported in Hz units. Mass spectra were obtained on a VG micro mass 7070H spectrometer. Elemental analyses (C, H, N) determined by a Perkin–Elmer 240 CHN elemental analyzer, are within ± 0.4% of theoretical.

Preparation of 3,5-dimethyl-1-phenyl-1*H*-pyrazole (2): A mixture of acetyl acetone **1** (1.95 g, 0.02 mol) and phenyl hydrazine hydrochloride (2.89 g, 0.02 mol) in ethanol (20 mL) was heated under reflux for 3 h on a water bath. After completion of the reaction, ethanol was evaporated. The residue was poured in ice-cold water, neutralized with sodium bicarbonate and extracted with ether. The solvent was evaporated under reduced pressure to get the compound **2** as yellow-brown liquid; yield 90%; bp 270–272 °C; IR (KBr) ί 3010, 2962, 1630, 1610 cm^{-1}; ^{1}H NMR ($CDCl_3$): δ 2.22 (s, 3H, CH_3), 2.36 (s, 3H, CH_3), 6.21 (s, 1H, ArH), 7.10–7.20 (m, 5H, ArH); ^{13}C NMR ($CDCl_3$): δ 13.9, 14.6, 108.5, 123.4, 127.3, 129.0, 140.1, 141.7, 145.4; MS *m/z*: 172 (M^+); Anal. Calcd for $C_{11}H_{12}N_2$: C, 76.71; H, 7.02; N, 16.27. Found: C, 76.77; H, 6.95; N, 16.16.

Preparation of 3,5-dimethyl-1-phenyl-1*H*-4-pyrazolecarbaldehyde (3): To a cold *N*,*N*-dimethyl- formamide (1.55 mL, 0.02 mol), freshly distilled phosphorous oxychloride (1.0 mL, 0.01 mol) was added with stirring over a period of 30 minutes. When formylation solution was obtained, a solution of compound **2** (1.72 g, 0.01 mol) in *N*,*N*-dimethylformamide (5 mL) was added drop wise,

while maintaining the temperature at 0–5 °C. The resulting mixture was heated under reflux for 1 h, cooled and poured with continuous stirring onto crushed ice and the obtained yellow precipitate was filtered off and recrystallized from aqueous ethanol to get the pure compound **3** as yellow solid; yield 86%; mp 124–126 °C. IR (KBr) í 3012, 2961, 2854, 1700, 1627, 1608 cm^{-1}; ^1H NMR ($CDCl_3$): δ 2.64 (s, 3H, CH_3), 2.71 (s, 3H, CH_3), 7.15–7.25 (m, 5H, ArH), 9.98 (s, 1H, CHO); ^{13}C NMR ($CDCl_3$): δ 12.2, 14.4, 123.1, 127.0, 128.4, 129.4, 139.5, 145.7, 151.5, 182.3; MS *m/z*: 200 (M^+); Anal. Calcd for $C_{12}H_{12}N_2O$: C, 71.98; H, 6.04; N, 13.99. Found: C, 71.94; H, 6.00; N, 14.02.

General procedure for synthesis of 2-(3,5-dimethyl-1-phenyl-1*H*-4-pyrazolyl)-3-(aryl)-1,3-thiazolidin-4-ones 4a–h: To a stirred mixture of compound **3** (2.0 g, 0.01 mol), aryl/heteroaryl amine (0.01 mol) and thioglycolic acid (1.85 g, 0.02 mol) in dry toluene (10 mL), $ZnCl_2$ (1.36 g, 0.01 mol) was added and refluxed at 110 °C for 6 h. After cooling, the filtrate was concentrated to dryness under reduced pressure and the residue was taken-up in ethyl acetate. The ethyl acetate layer was washed with brine, 5% sodium bicarbonate solution and finally with brine. The organic layer was dried over Na_2SO_4 and evaporated to dryness at reduced pressure. The crude product thus obtained was purified by column chromatography on silica gel with hexane–ethyl acetate as eluent to afford pure compounds **4a**–**h**.

2-(3,5-Dimethyl-1-phenyl-1*H*-4-pyrazolyl)-3-phenyl-1,3-thiazolidin-4-one (4a). Yield 64%; mp 149–151 °C; IR (KBr) í 3032, 2965, 1710, 1624, 1600, 1518, 746 cm^{-1}; ^1H NMR (DMSO-d_6): δ 2.27 (s, 3H, CH_3), 2.34 (s, 3H, CH_3), 3.73 (s, 2H, CH_2-S), 5.64 (s, 1H, S-CH-N), 7.00–7.25 (m, 10H, ArH); ^{13}C NMR (DMSO-d_6): δ 11.4, 14.2, 36.6, 52.4, 115.2, 122.3, 124.3, 127.1, 127.8, 128.0, 128.9, 129.0, 137.3, 139.2, 151.1, 175.1; MS *m/z*: 350 (M^++1); Anal. Calcd for $C_{20}H_{19}N_3OS$: C, 68.74; H, 5.48; N, 12.02. Found: C, 68.70; H, 5.42; N, 12.08.

3-(4-Chlorophenyl)-2-(3,5-dimethyl-1-phenyl-1*H*-4-pyrazolyl)-1,3-thiazolidin-4-one (4b). Yield 66%; mp 138–140 °C; IR (KBr) í 3032, 2961, 1712, 1624, 1605, 1510, 748, 685 cm^{-1}; ^1H NMR (DMSO-d_6): δ 2.27 (s, 3H, CH_3), 2.34 (s, 3H, CH_3), 3.73 (s, 2H, CH_2-S), 5.64 (s, 1H, S-CH-N), 7.00–7.25 (m, 7H, ArH), 7.86 (d, *J* = 8.7 Hz, 2H, ArH); ^{13}C NMR (DMSO-d_6): δ 11.4, 14.2, 36.6, 52.3, 115.2, 122.6, 124.6, 127.1, 127.8, 128.9, 129.8, 131.6, 137.3, 139.1, 151.0, 174.1; MS *m/z*: 383 (M^+); Anal. Calcd for $C_{20}H_{18}ClN_3OS$: C, 62.57; H, 4.73; N, 10.95. Found: C, 62.60; H, 4.75; N, 10.91.

2-(3,5-Dimethyl-1-phenyl-1*H*-4-pyrazolyl)-3-(4-nitrophenyl)-1,3-thiazolidin-4-one (4c). Yield 71%; mp 143–145 °C; IR (KBr) í 3032, 2961, 1710, 1627, 1604, 1557, 1342, 749 cm^{-1}. ^1H NMR (DMSO-d_6): δ 2.27 (s, 3H, CH_3), 2.34 (s, 3H, CH_3), 3.73 (s, 2H, CH_2-S), 5.64 (s, 1H, S-CH-N), 7.00-7.20 (m, 5H, ArH), 7.82 (d, *J* = 8.8 Hz, 2H, ArH), 8.10 (d, *J* = 8.8 Hz, 2H, ArH); ^{13}C NMR (DMSO-d_6): δ 11.3, 14.1, 36.6, 52.3, 115.2, 122.5, 124.4, 127.8, 128.1, 128.9, 133.2, 137.3, 139.3, 144.2, 150.7, 174.2; MS *m/z*: 394 (M^+); Anal. Calcd for $C_{20}H_{18}N_4O_3S$: C, 60.90; H, 4.60; N, 14.20. Found: C, 60.83; H, 4.64; N, 14.15.

2-(3,5-Dimethyl-1-phenyl-1*H*-4-pyrazolyl)-3-(2-methylphenyl)-1,3-thiazolidin-4-one (4d). Yield 68%; mp 136–138 °C; IR (KBr) í 3035, 2962, 1710, 1625, 1602, 748 cm^{-1}; ^1H NMR (DMSO-d_6): δ 2.14 (s, 3H, CH_3), 2.27 (s, 3H, CH_3), 2.34 (s, 3H, CH_3), 3.73 (s, 2H, CH_2-S), 5.64 (s, 1H, S-CH-N), 7.10–7.35 (m, 9H, ArH); ^{13}C NMR (DMSO-d_6): δ 11.2, 14.0, 18.2, 36.0, 50.7, 115.3, 122.4, 125.3, 126.6, 127.0, 127.8, 128.1, 128.8, 131.2, 133.4, 137.3, 139.1, 150.7, 173.6; MS *m/z*: 364 (M^++1); Anal. Calcd for $C_{21}H_{21}N_3OS$: C, 69.39; H, 5.82; N, 11.56. Found: C, 69.33; H, 5.80; N, 11.61.

2-(3,5-Dimethyl-1-phenyl-1*H*-4-pyrazolyl)-3-(4-methylphenyl)-1,3-thiazolidin-4-one (4e). Yield 70%; mp 139–141 °C; IR (KBr) í 3032, 2965, 1710, 1626, 1602, 746 cm^{-1}; ^1H NMR (DMSO-d_6): δ 2.11 (s, 3H, CH_3), 2.27 (s, 3H, CH_3), 2.34 (s, 3H, CH_3), 3.73 (s, 2H, CH_2-S), 5.64 (s, 1H, S-CH-N), 7.10–7.30 (m, 7H, ArH), 7.54 (d, *J* = 8.2 Hz, 2H, ArH); ^{13}C NMR (DMSO-d_6): δ 11.3, 14.1, 22.6, 36.4, 52.3, 115.0, 118.2, 122.5, 126.6, 127.8, 128.8, 129.4, 136.8, 137.2, 139.1, 151.0, 174.2; MS *m/z*: 363 (M^+); Anal. Calcd for $C_{21}H_{21}N_3OS$: C, 69.39; H, 5.82; N, 11.56. Found: C, 69.40; H, 5.58; N, 11.51.

2-(3,5-Dimethyl-1-phenyl-1*H*-4-pyrazolyl)-3-(4-hydroxyphenyl)-1,3-thiazolidin-4-one (4f). Yield 72%; mp 151–153 °C; IR (KBr) í 3375, 3032, 1710, 1630, 1604, 745 cm^{-1}; ^1H NMR (DMSO-d_6): δ 2.27 (s, 3H, CH_3), 2.34 (s, 3H, CH_3), 3.73 (s, 2H, CH_2-S), 5.64 (s, 1H, S-CH-N), 6.21 (s, 1H, OH), 6.91 (d, *J* = 8.6 Hz, 2H, ArH), 7.10–7.25 (m, 5H, ArH), 7.49 (d, *J* = 8.6 Hz, 2H, ArH); ^{13}C NMR (DMSO-d_6): δ 11.2, 14.2, 36.4, 51.4, 115.0, 118.2, 120.7, 122.0, 122.4, 127.8, 128.8, 137.1, 139.0, 151.0, 152.7, 174.2; MS *m/z*: 366 (M^++1); Anal. Calcd for $C_{20}H_{19}N_3O_2S$: C, 65.73; H, 5.24; N, 11.50. Found: C, 65.76; H, 5.19; N, 11.42.

2-(3,5-Dimethyl-1-phenyl-1*H*-4-pyrazolyl)-3-(4-pyridyl)-1,3-thiazolidin-4-one (4g). Yield 70%; mp 161–163 °C; IR (KBr) í 3018, 2910, 1710, 1627, 1600, 1595, 746 cm^{-1}; ^1H NMR (DMSO-d_6): δ 2.27 (s, 3H, CH_3), 2.34 (s, 3H, CH_3), 3.73 (s, 2H, CH_2-S), 5.64 (s, 1H, S-CH-N), 7.05–7.20 (m, 5H, ArH), 7.36 (d, *J* = 5.9 Hz, 2H, ArH), 8.05 (d, *J* = 5.9 Hz, 2H, ArH); ^{13}C NMR (DMSO-d_6): δ 11.4, 14.2, 36.7, 52.0, 113.7, 115.1, 122.6, 127.8, 128.8, 137.2, 139.1, 140.1, 151.1, 152.0, 174.3; MS *m/z*: 350

(M^+); Anal. Calcd for $C_{19}H_{18}N_4OS$: C, 65.12; H, 5.18; N, 15.99. Found: C, 65.06; H, 5.23; N, 15.92.

2-(3,5-Dimethyl-1-phenyl-1*H*-4-pyrazolyl)-3-(2-pyrimidinyl)-1,3-thiazolidin-4-one (4h). Yield 68%; mp 157–159 °C; IR (KBr) í 3020, 2942, 1710, 1630, 1600, 1595, 749 cm^{-1}; ^1H NMR (DMSO-d_6): δ 2.27 (s, 3H, CH_3), 2.34 (s, 3H, CH_3), 3.73 (s, 2H, CH_2-S), 5.64 (s, 1H, S-CH-N), 7.10-7.25 (m, 7H, ArH), 8.52 (d, J = 5.6 Hz, 2H, ArH); ^{13}C NMR (DMSO-d_6): δ 11.4, 14.2, 36.0, 50.7, 115.1, 117.5, 122.5, 127.8, 128.8, 137.2, 139.1, 146.7, 151.1, 159.0, 172.7; MS *m/z*: 352 (M^++1); Anal. Calcd for $C_{18}H_{17}N_5OS$: C, 61.52; H, 4.88; N, 19.94. Found: C, 61.56; H, 4.81; N, 19.87.

5. Conclusions

A series of novel 2-(3,5-dimethyl-1-phenyl-1*H*-4-pyrazolyl)-3-(aryl/heteroaryl)-1,3-thiazolidin-4-one derivatives **4a**–**h** has been synthesized readily in one-pot from the 3,5-dimethyl-1-phenyl-1*H*-4-pyrazolecarbaldehyde **3** and evaluated their antibacterial activity against various bacteria. The compounds containing pyridyl **4g** and pyrimidinyl **4h** moiety showed enhanced antibacterial activity against *S. aureus* and *E. coli* at the concentration less than both the standards neomycin and streptomycin and emerged as potential molecules for further development.

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Povzetek

Z »one-pot« sintezo smo iz 1-fenil-3,5-dimetil-1*H*-4-pirazolkarbaldehida (**3**) pripravili serijo novih derivatov 2-(1-fenil-3,5-dimetil-1*H*-4-pirazolil)-3-(aril/heteroaril)-1,3-tiazolidin-4-onov **4a**–**h** ter jih analizirali z IR, NMR, MS in elementno analizo. Tem spojinam smo določili antibakterijsko delovanje (MIC) proti *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli* in *Staphylococcus pyogenes.* Med novimi spojinami sta spojini, ki vsebujeta piridilno **4g** in pirimidinilno **4h** skupino, pokazali odlično antibakterijsko delovanje proti *S. aureus* in *E. coli* že pri koncentracijah 6.25 μg/mL, kar je manj, kot so bile potrebne koncentracije standardnih spojin (neomcin in streptomcin); s tem sta se ti dve izkazali kot možni potencialni spojini za nadaljnje predelave.