Selenium containing heterocycles: Synthesis and antimicrobial evaluation of some new 4-substituted-2-(4-phenyl-2-(piperidin-1-yl)-1, 3-selenazol-5-yl) phthalazin-1(2H)-ones

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Abstract: A series of some new 1, 3-selenazoles substituted phthalazinone derivatives were synthesized by treating of 4-alkyl/aryl-phthalazin-1(2H)-one 2 with piperidine-1-carboselenoamide (3) in the presence in presence of ferric chloride. The structure of synthesized new compounds were characterized by spectral data and screened for their antimicrobial activities against various bacteria and fungi strains. Several of these compounds showed excellent antimicrobial activity.

[Ibrahim E. El-Shamy, A. M. Abdel-Mohsen, Mohammed M. Al-Shehri, Maher A. El-Hashash, andKhalid M. Al-Shamrani. **Selenium containing heterocycles: Synthesis and antimicrobial evaluation of some new 4-substituted-2-(4-phenyl-2-(piperidin-1-yl)-1, 3-selenazol-5-yl) phthalazin-1(2H)-ones.** *Life Sci J* 2014;11(3):385-391]. (ISSN:1097-8135). http://www.lifesciencesite.com. 54

Keywords: Selenium containing heterocyclic, phthalazin-1(2H)-ones

1. Introduction

Nitrogen-containing heterocyclic compounds constitute the largest portion of chemical entities, which are part of many natural products, fine chemicals, and biologically active pharmaceuticals. Phthalazines are examples of nitrogen heterocycles that play a vital role in many biological processes and as synthetic drugs. Phthalazin-1(2H)-one derivatives are of considerable interest due to their antidiabetic [1], antiallergic [2], vasorelaxant [3], PDE4 inhibitors [4], VEGF (vascular endothelial growth factor) receptor tyrosine kinases for the treatment of cancer [5], antiasthmatic agents [6], herbicidal [7] like activities. A number of established drug molecules like Hydralazine [8-9], Budralazine [10-11], Azelastine [12-13], Ponalrestat [14] and Zopolrestat [15] were prepared from the corresponding phthalazinones. On the other hand, the introduction of selenium element into organic compounds often permits modification of their chemical properties and biological activities [16–20]. The unique biochemical and pharmaceutical properties of organoselenium compounds make them very attractive, in particular for bioorganic and medicinal chemists. Such compounds, especially selenium containing heterocycles, have gradually gained importance over the last 25 years. Among a large variety of Se-containing heterocycles, heterocyclic compounds containing the 1,3-selenazoles moiety are of interest due to their pharmacological and biological activities [21]. Several reviews [22] describe their preparation [23] and pharmaceutical potential [24]. They have been studied widely, for example, as anticancer [25] and anti-radiation agents [26], as protein kinase activators [27], and as superoxide anion scavengers [28]. The diverse biological activities of phthalazin-1(2H)-one, and 1,3-selenazoles pharmacophores envisaged us to plan a new lead compounds that may exhibit wide pharmacological activities. By combining these pharmacophore components in a molecule to give a compact system, we designed and synthesized a series of phthalazin-1(2H)-one derivatives containing 1,3-selenazole moieties.

2. Experimental

Melting points were determined on a MEL-TEMP II melting point apparatus in open glass capillaries and are uncorrected. The infrared spectra IR were recorded for potassium bromide disks on a Pye-Unicam SP1025 spectrophotometer. NMR spectra were obtained at ambient temperature (~25 ◦ C) with a Bruker AC-250 spectrometer or with a Varian Gemini 200 spectrometer at 250 MHz using tetramethylsilane (TMS) as an internal standard. Mass spectra (MS) were obtained on a Hewlett-Packard 5995 gas chromatography-mass spectrometer

system or on a Shimadzu GCMS-QP 1000 EX mass spectrometer. Homogeneity of the products and follow up of the reactions were checked by ascending thin-layer chromatography TLC on plates precoated with silica gel G (E. Merck; layer thickness 0.25 mm), used without pretreatment. Plates pre-coated with silica gel G (E. Merck; layer thickness 0.25 mm), used without pretreatment.

General procedure for preparation of 4-substituted-2-(2-oxo-2-phenylethyl)phthalazin-1(2H)-one (2a-j).

A mixture of phthalazinone derivative 1 (0.01 mol), phenacylbromide (0.03 mol) and potassium carbonate (4.1 g, 0.03 mol) in 30 mL dry acetone was heated under reflux for 30 h, cooled at room temperature and poured into water. The obtained solid was filtered off and crystallized from petroleum ether 40–60 oC to give 2.

4-Phenyl-2-(2-oxo-2-phenylethyl)phthalazin-1(2H)-one (2a). M.p.190–191 oC; yield 66%; 1H NMR (DMSO-d6) δ: 4.91 (s, 2H, CH2), 7.01–8.23 (m, 14H, Ar–H); IR (KBr) v: 1705, 1661 (2CO)cm-1; MS (70 eV) m/z (%):340 (M+, 19). Anal. calcd. for C22H16N2O2: C, 77.63; H, 4.74; N, 8.23; found C, 77.60; H, 4.78; N, 8.20.

4-(4-Methoxyphenyl)-2-(2-oxo phenylethyl)phthalazin-1(2H)-one (2b). M.p.163–164 oC; yield 60%; 1H NMR (DMSO-d6) δ: 4.10 (s, 3H, OCH3), 5.01 (s, 2H, CH2), 7.10–8.20 (m, 13H, Ar–H); 13C NMR (DMSO-d6) δ: 58.3(OCH3), 67.4(CH2), 118.2, 124.0, 124.8, 127.1, 127.9, 128.4, 129.0, 129.7, 130.5, 132.8, 133.8, 137.0, 137.6, 138.2, 160.3(CO), 165.1, 190.3 (COPh)); IR (KBr) v: 1709, 1660 (2CO) cm-1; MS (70 eV) m/z (%):370 (M+, 11). Anal. calcd. for C23H18N2O3: C, 74.58; H, 4.90; N, 7.56; found C, 74.62; H, 4.92; N, 7.52.

4-(4-Chlorophenyl)-2-(2-oxo-2-phenylethyl)phthalazin-1(2H)-one (2c). M.p.152–153 oC; yield 65%; 1H NMR (DMSO-d6) δ: 4.98 (s, 2H, CH2), 7.13–8.19 (m, 13H, Ar–H); IR (KBr) v: 1711, 1668 (2CO) cm-1. Anal. calcd. for C22H15ClN2O2: C, 70.50; H, 4.03; Cl, 9.46; N, 7.47; found C, 70.55; H, 4.09; Cl, 9.40; N, 7.43.

4-(3,4-Dichlorophenyl)-2-(2-oxo-2-phenylethyl)phthalazin-1(2H)-one (2d). M.p.170–171 oC; yield 74%; 1H NMR (DMSO-d6) δ: 5.04 (s, 2H, CH2), 7.15–8.28 (m, 12H, Ar–H); IR (KBr) v: 1710, 1665 (2CO) cm-1. Anal. calcd. for C22H14Cl2N2O2: C, 64.56; H, 3.45; Cl, 17.33; N, 6.84; found C, 64.59; H, 3.45; Cl, 17.30; N, 6.86.

4-(4-(4-Chlorobenzyl)phenyl)-2-(2-oxo-2-phenylethyl)phthalazin-1(2H)-one (2e). M.p.193–194 oC; yield 70%; 1H NMR (DMSO-d6) δ: 4.26 (s, 2H, CH2), 4.89 (s, 2H, CH2), 7.00–8.25 (m, 17H, Ar–H); 13C NMR (DMSO-d6) δ: 47.1(CH2), 65.0(CH2CO), 122.5, 124.8, 126.9, 128.4, 128.9, 129.8, 130.3, 130.8, 131.7, 132.0, 132.3, 132.9, 133.2, 133.8, 134.7, 135.2, 135.8, 140.2, 144.8, 163.2(CO), 194.6 (COPh); IR (KBr) v: 1715, 1667 (2CO) cm-1. Anal. calcd. for C29H21ClN2O2: C, 74.91; H, 4.55; Cl, 7.63; N, 6.03; found C, 74.95; H, 4.51; Cl, 7.67; N, 6.00.

4-(3-Chloro-4-methylphenyl)-2-(2-oxo-2-phenylethyl)phthalazin-1(2H)-one (2f). M.p.155–156 oC; yield 63%; 1H NMR (DMSO-d6) δ: 2.47 (s, 3H, CH3), 4.96 (s, 2H, CH2), 7.08–8.27 (m, 12H, Ar–H); IR (KBr) v: 1710, 1670 (2CO) cm-1. Anal. calcd. for C23H17ClN2O2: C, 71.04; H, 4.41; Cl, 9.12; N, 7.20; found C, 71.00; H, 4.49; Cl, 9.10; N, 7.23.

4-Mesityl-2-(2-oxo-2-phenylethyl)phthalazin-1(2H)-one (2g). M.p.142–143 oC; yield 66%; 1H NMR (DMSO-d6) δ: 2.38 (s, 3H, CH3), 2.49 (s, 6H, 2CH3), 4.99 (s, 2H, CH2), 7.15–8.20 (m, 11H, Ar–H); 13C NMR (DMSO-d6) δ: 20.3(2CH3), 22.7(CH3), 65.4(CH2CO), 124.1, 125.9, 127.8, 128.4, 128.9, 129.3, 130.5, 132.4, 132.9, 133.6, 134.1, 135.8, 136.2, 139.7, 141.2, 162.6(CO), 191.1 (COPh));IR (KBr) v: 1708, 1669 (2CO) cm-1; MS (70 eV) m/z (%):382 (M+, 16). Anal. calcd. for C25H22N2O2: C, 78.51; H, 5.80; N, 7.32; found C, 78.50; H, 5.77; N, 7.30.

4-(4-Benzylphenyl)-2-(2-oxo-2-phenylethyl)phthalazin-1(2H)-one (2h). M.p.188–189 oC; yield 61%; 1H NMR (DMSO-d6) δ: 4.20 (s, 2H, CH2), 4.94 (s, 2H, CH2), 7.02–8.27 (m, 18H, Ar–H); IR (KBr) v: 1703, 1662 (2CO) cm-1; MS (70 eV) m/z (%):430 (M+, 8). Anal. calcd. for C29H22N2O2: C, 80.91; H, 5.15; N, 6.51; found C, 80.88; H, 5.10; N, 6.50.

4-(Pyridin-4-ylmethyl)phenyl)-2-(2-oxo-2-phenylethyl)phthalazin-1(2H)-one (2i). M.p.150–151 oC; yield 77%; 1H NMR (DMSO-d6) δ: 4.00 (s, 2H, CH2), 5.08 (s, 2H, CH2), 7.05–8.70 (m, 17H, Ar–H and pyridine protons); IR (KBr) v: 1708, 1664 (2CO) cm-1; MS (70 eV) m/z (%):431 (M+, 5). Anal. calcd. for C28H21N3O2: C, 77.94; H, 4.91; N, 9.74; found C, 77.90; H, 4.97; N, 9.78.

4-(Biphenyl-4-yl)-2-(2-oxo-2-phenylethyl)phthalazin-1(2H)-one (2j). M.p.195–196 oC; yield 60%; 1H NMR (DMSO-d6) δ: 4.79 (s, 2H, CH2), 7.05–8.29 (m, 18H, Ar–H); IR (KBr) v: 1701, 1660 (2CO) cm-1; MS (70 eV) m/z (%):416 (M+, 44). Anal. calcd. for C28H20N2O2: C, 80.75; H, 4.84; N, 6.73; found C, 80.81; H, 4.82; N, 6.77.

General procedure for preparation 4-substituted-2-(4-phenyl-2-(piperidin-1-yl)-1,3-selenazol-5-yl)phthalazin-1(2H)-ones (4a-j).

Phthalazinone derivative 3a-j (0.009 mol) was added to a stirred solution of piperidine-1-carboselenoamide (3) (0.003 mol) in dry ethanol (10 mL) under an argon atmosphere. Ferric chloride (0.19 g, 1.2 mmol)

was added into the reaction mixture. The reaction mixture was refluxed for 3 h. The mixture was extracted with diethyl ether and washed with H2O. The organic layer was dried over sodium sulfate and evaporated to dryness. The residue was purified by flash chromatography on silica gel with dichloromethane: n-hexane (2:1) to give 4a-j.

4-Phenyl-2-(4-phenyl-2-(piperidin-1-yl)-1,3-selenazol-5-yl)phthalazin-1(2H)-one (4a). M.p.110–111 oC; yield 42%; 1H NMR (DMSO-d6) δ: 1.60–1.72 (6H, m, CH2 piperidine moiety), 3.55 (4H, t, J =5.2 Hz, CH2 piperidine moiety), 7.05–8.19 (m, 14H, Ar–H); IR (KBr) v: 1662 (CO), 1603(C=N) cm-1; MS (70 eV) m/z (%): 512 (M+, 22). Anal. calcd. for C28H24N4OSe: C, 65.75; H, 4.73; N, 10.95; found C, 65.70; H, 4.77; N, 10.90.

4-(4-Methoxyphenyl)-2-(4-phenyl-2-(piperidin-1-yl)-1,3-selenazol-5-yl)phthalazin-1(2H)-one (4b). M.p.101–102 oC; yield 55%; 1H NMR (DMSO-d6) δ: 1.60–1.72 (6H, m, CH2 piperidine moiety), 3.40–3.43 (4H, m, CH2 piperidine moiety), 4.13 (s, 3H, OCH3), 7.11–8.27 (m, 13H, Ar–H); 1H NMR (DMSO-d6) δ: 4.10 (s, 3H, OCH3), 5.01 (s, 2H, CH2), 7.10–8.20 (m, 13H, Ar–H); 13C NMR (DMSO-d6) δ: 25.1(CH2 of piperidine), 25.9(2CH2 of piperidine), 52.0(CH2N of piperidine), 58.7(OCH3), 112.0, 117.2, 124.1, 125.0, 127,0, 127.8, 128.7, 129.0, 129.4, 129.8, 130.5, 131.9, 132.4, 133.6, 135.0, 137.1, 161.1(CO), 166.0, 168.0; IR (KBr) v: 1660 (CO), 1605(C=N) cm-1; MS (70 eV) m/z (%):542 (M+, 13). Anal. calcd. for C29H26N4O2Se: C, 64.32; H, 4.84; N, 10.35; found C, 64.32; H, 4.84; N, 10.35.

4-(4-Chlorophenyl)-2-(4-phenyl-2-(piperidin-1-yl)-1,3-selenazol-5-yl)phthalazin-1(2H)-one (4c). M.p.92–93 oC; yield 57%; 1H NMR (DMSO-d6) δ: 1.58–1.67 (6H, m, CH2 piperidine moiety), 3.32–3.37 (4H, m, CH2 piperidine moiety), 7.10–8.20 (m, 13H, Ar–H); 13C NMR (DMSO-d6) δ: 25.2(CH2 of piperidine), 25.8(2CH2 of piperidine), 52.3(CH2N of piperidine), 113.1, 123.0, 125.2, 127.0, 127.7, 128.1, 128.5, 129.0, 129.4, 129.9, 130.5, 131.5, 131.9, 132.1, 135.1, 137.3, 137.8, 162.0(CO), 166.1; IR (KBr) v: 1660 (CO), 1605(C=N) cm-1; MS (70 eV) m/z (%):546 (M+, 32). Anal. calcd. for C28H23ClN4OSe: C, 61.60; H, 4.25; Cl, 6.49; N; found C, 61.67; H, 4.20; Cl, 6.53; N.

4-(3,4-Dichlorophenyl)-2-(4-phenyl-2-(piperidin-1-yl)-1,3-selenazol-5-yl)phthalazin-1(2H)-one (4d). M.p.100–101 oC; yield 52%; 1H NMR (DMSO-d6) δ: 1.61–1.74 (6H, m, CH2 piperidine moiety), 3.55 (4H, t, J =5.2 Hz, CH2 piperidine moiety), 7.09–8.26 (m, 12H, Ar–H);; IR (KBr) v: 1666 (CO), 1608(C=N) cm-1; MS (70 eV) m/z (%):580 (M+, 12). Anal. calcd. for C28H22Cl2N4OSe: C, 57.95; H, 3.82; Cl, 12.22; N, 9.65; found C, 57.90; H, 3.88; Cl, 12.20; N, 9.61.

4-(4-(4-Chlorobenzyl)phenyl)-2-(4-phenyl-2-(piperidin-1-yl)-1,3-selenazol-5-yl)phthalazin-1(2H)-one (4e). M.p.131–132 oC; yield 44%; 1H NMR (DMSO-d6) δ: 1.63–1.70 (6H, m, CH2 piperidine moiety), 3.40–3.48 (4H, m, CH2 piperidine moiety), 4.20 (s, 2H, CH2), 7.04–8.27 (m, 17H, Ar–H); 13C NMR (DMSO-d6) δ: 25.0(CH2 of piperidine), 25.9(2CH2 of piperidine), 42.2(CH2), 52.3(CH2N of piperidine), 112.2, 124.1, 126.3, 126.8, 127.0, 127.7, 129.0, 129.4, 129.9, 130.2, 132.7, 133.0, 133.4, 133.8, 134.7, 135.0, 135.5, 136.0, 136.9, 140.1, 142.2, 161.7(CO), 167.0; IR (KBr) v: 1664 (CO), 1606(C=N) cm-1; MS (70 eV) m/z (%):636 (M+, 8). Anal. calcd. for C35H29ClN4OSe: C, 66.09; H, 4.60; Cl, 5.57; N, 8.81; found C, 66.13; H, 4.64; Cl, 5.59; N, 8.77.

4-(3-Chloro-4-methylphenyl)-2-(4-phenyl-2-(piperidin-1-yl)-1,3-selenazol-5-yl)phthalazin-1(2H)-one (4f). M.p.80–81 oC; yield 56%; 1H NMR (DMSO-d6) δ: 1.59–1.67 (6H, m, CH2 piperidine moiety), 2.47 (s, 3H, CH3), 3.33-3.40 (4H, m, CH2 piperidine moiety), 7.05–8.25 (m, 12H, Ar–H); 13C NMR (DMSO-d6) δ: 20.2(CH3), 25.2(CH2 of piperidine), 25.8(2CH2 of piperidine), 52.3(CH2N of piperidine), 112.4, 120.2, 124.0, 125.3, 126.1, 126.7, 127.3, 128.0, 128.5, 129.3, 129.9, 131.0, 131.6, 132.1, 132.7, 133.4, 135.0, 135.9, 137.1, 160.0(CO), 165.2; IR (KBr) v: 1667 (CO), 1605(C=N) cm-1; MS (70 eV) m/z (%):559 (M+, 9). Anal. calcd. for C29H25ClN4OSe: C, 62.20; H, 4.50; Cl, 6.33; N, 10.01; found C, 62.15; H, 4.55; Cl, 6.30; N, 10.04.

4- Mesityl -2-(4-phenyl-2-(piperidin-1-yl)-1,3-selenazol-5-yl)phthalazin-1(2H)-one (4g). M.p.96–97 oC; yield 50%; 1H NMR (DMSO-d6) δ: 1.60–1.69 (6H, m, CH2 piperidine moiety), 2.38 (s, 3H, CH3), 2.49 (s, 6H, 2CH3), 3.44-3.51 (4H, m, CH2 piperidine moiety), 7.12–8.25 (m, 11H, Ar–H); IR (KBr) v: 1659 (CO), 1601(C=N) cm-1; MS (70 eV) m/z (%):553 (M+, 16). Anal. calcd. for C31H30N4OSe: C, 67.26; H, 5.46; N, 10.12; found C, 67.20; H, 5.49; N, 10.10.

4-(4-Benzylphenyl)-2-(4-phenyl-2-(piperidin-1-yl)-1,3-selenazol-5-yl)phthalazin-1(2H)-one (4h). M.p.104–105 oC; yield 57%; 1H NMR (DMSO-d6) δ: 1.62–1.70 (6H, m, CH2 piperidine moiety), 3.48-3.53 (4H, m, CH2 piperidine moiety), 4.20 (s, 2H, CH2), 7.01–8.30 (m, 18H, Ar–H); IR (KBr) v: 1663 (CO), 1604(C=N) cm-1; MS (70 eV) m/z (%):601 (M+, 18). Anal. calcd. for C35H30N4OSe: C, 69.88; H, 5.03; N, 9.31; found C, 69.93; H, 4.99; N, 9.35.

4-(Pyridin-4-ylmethyl)phenyl)-2-(4-phenyl-2-(piperidin-1-yl)-1,3-selenazol-5-yl)phthalazin-1(2H)-one (4i). M.p.110–112 oC; yield 60%; 1H NMR (DMSO-d6) δ: 1.60–1.69 (6H, m, CH2

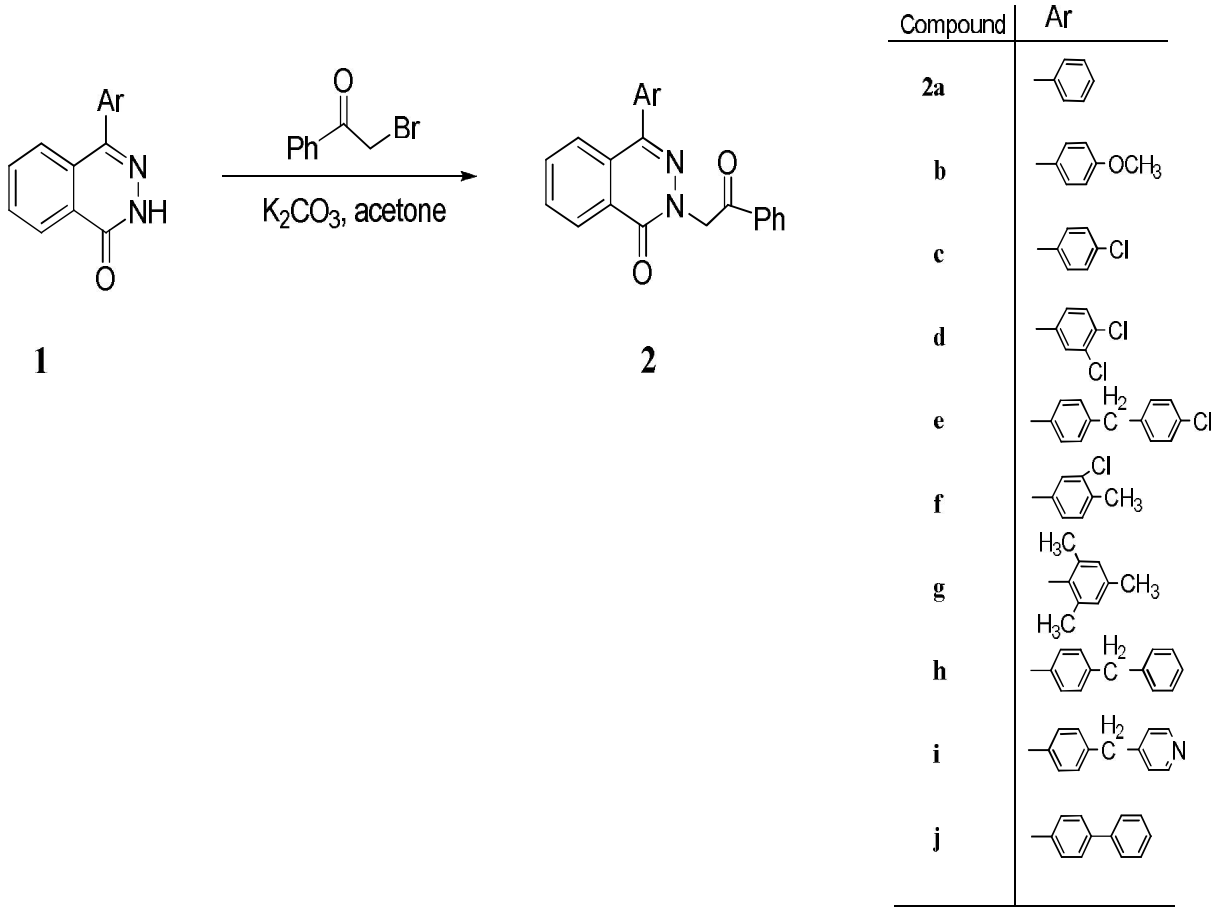
piperidine moiety), 3.41-3.49 (4H, m, CH2 piperidine moiety), 4.04 (s, 2H, CH2), 7.01–8.71 (m, 17H, Ar–H and pyridine protons); 13C NMR (DMSO-d6) δ: 25.1(CH2 of piperidine), 25.8(2CH2 of piperidine), 45.3(CH2), 52.6(CH2N of piperidine), 112.7, 123.0, 123.8, 125.3, 126.0, 127.2, 127.8, 128.4, 128.8, 129.5, 130.4, 131.7, 131.9, 132.8, 134.5, 135.7, 138.8, 139.1, 145.5, 150.1, 161.0(CO), 166.5; IR (KBr) v: 1664 (CO), 1607(C=N) cm-1; MS (70 eV) m/z (%):602 (M+, 9). Anal. calcd. for C34H29N5OSe: C, 67.77; H, 4.85; N, 11.62; found C, 67.79; H, 4.80; N, 11.60.

4-(Biphenyl-4-yl)-2-(4-phenyl-2-(piperidin-1-yl)-1,3-selenazol-5-yl)phthalazin-1(2H)-one (4j). M.p.124–125 oC; yield 61%; 1H NMR (DMSO-d6) δ: 1.63–1.70 (6H, m, CH2 piperidine moiety), 3.39-3.46 (4H, m, CH2 piperidine moiety), 7.01–8.28 (m, 18H, Ar–H); IR (KBr) v: 1660 (CO), 1605(C=N) cm-1; MS (70 eV) m/z (%):587 (M+, 17). Anal. calcd. for C34H28N4OSe: C, 69.50; H, 4.80; N, 9.54; found C, 69.44; H, 4.85; N, 9.51.

3. Results and Discussion

3.1. Synthesis

Treatment of phthalazin-1(2H)-one derivative 1 with phenacyl bromide in refluxing acetone in presence of potassium carbonate afforded the corresponding ketones 2a-j. The structure of compounds 2a-j was confirmed on the basis of their elemental analysis and spectral data. The IR spectrum showed a characteristic absorption band at ν 1703-1715 and 1660-1670 cm-1 corresponding to 2 CO groups. The 1HNMR spectrum of compounds 2a-j displayed CH2CO protons as a singlet signal at 4.79-5.04 ppm.

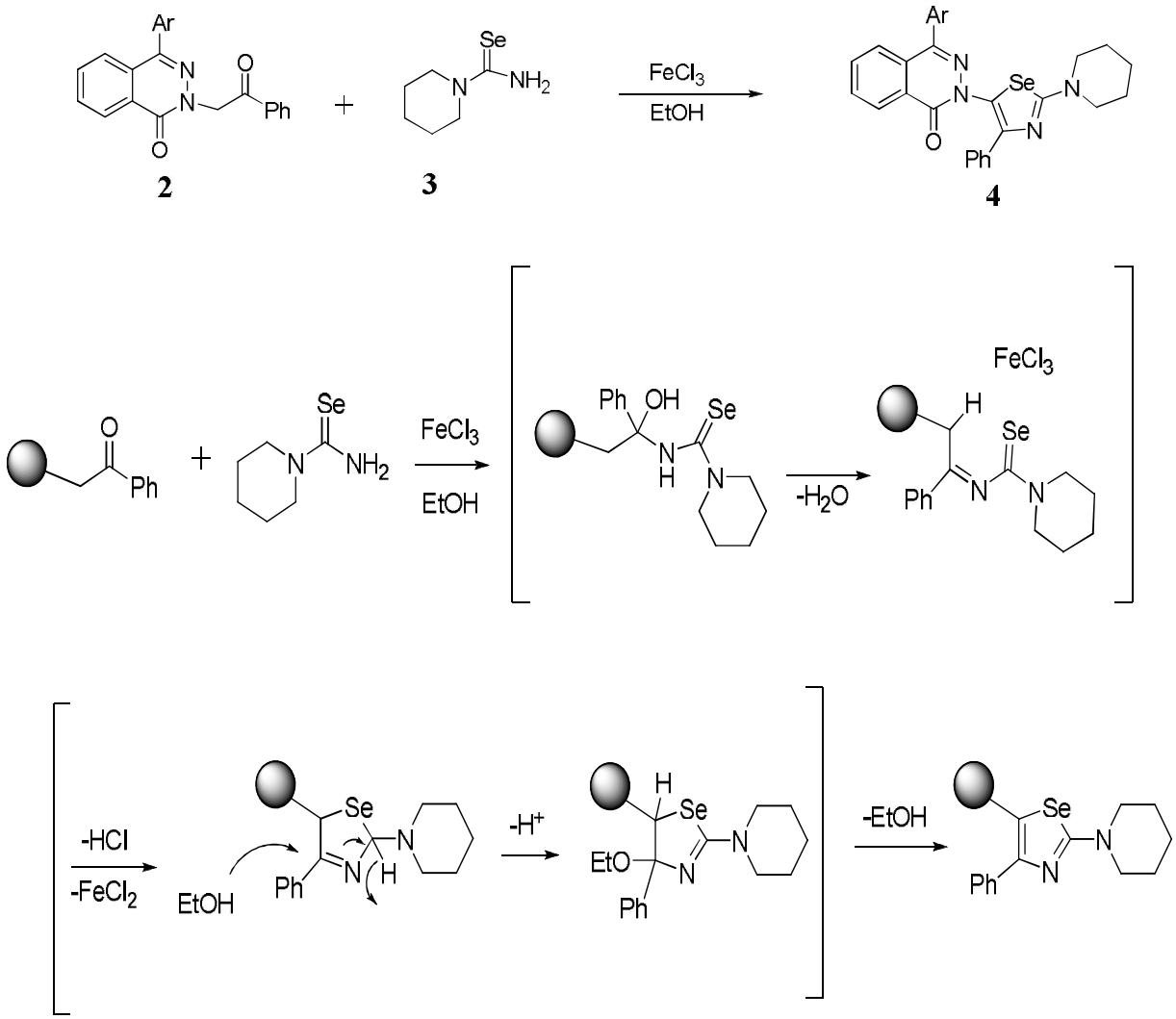


Scheme 1. Synthesis ketones 2 (a-j)

Interaction of 4-substituted-2-(2-oxo-2-phenylethyl) phthalazin-1(2H)-one (2) with piperidine-1-carboselenoamide (3) in absolute ethanol in presence of ferric chloride under an argon atmosphere afforded the corresponding 1,3-selenazolyl phthalazinone derivatives 4a-j in

moderate to high yields (Scheme 2). The IR spectrum revealed no absorption for COCH2 group. The 13CNMR spectrum of compounds 4a-j exhibited the expected number of signals for the aromatic carbons as well as piperidine moiety signals.

The reaction of selenourea derivative 3 with 2-(2-oxo-2-phenylethyl) phthalazinone derivatives of type 2 is initiated by the addition of the nitrogen atom of the selenourea to the carbonyl group, affording 1,3-selenazole of type 4 according to the following mechanism.



Scheme 2: mechanism of interaction of phthalazinone derivatives

3.2. Biological activities

The antimicrobial activity of the newly synthesized compounds 4a-j were evaluated against Escherichia coli, Staphylococcus aureus, Bacillus subtilis, Salmonella typhi bacterial strains and Aspergillums niger and Candida albicans fungal strains by disk diffusion method. Amoxicillin and Ketoconazole were used as standard drugs for the bacteria and fungi, respectively. Preliminary screening of phthalazine-derivatives and standard drugs was performed at fixed concentrations of 500 µg/mL. Inhibition was recorded by measuring the diameter of the inhibition zone at the end of 24 h for bacteria and 72 h for fungi. Each experiment was repeated twice. Based on the results of zone of inhibition, the minimum inhibitory concentration (MIC) of compounds 4a-j against all bacterial and fungal strains was determined by liquid dilution method. Stock solutions of tested compounds with 500, 250, 200, 100, 62.5, 50, 25 and 12.5 µg mL−1 concentrations were prepared with DMSO solvent. The solutions of standard drugs, Amoxicillin and Ketoconazole, were prepared in the same concentrations. Inoculums of the bacterial and fungal

culture were also prepared. To a series of tubes containing 1 mL each of phthalazine compound solution with different concentrations and 0.2 mL of the inoculums was added. Further 3.8 mL of sterile water was added to each of the test tubes. These test tubes were incubated for 24 h at 37 oC and observed for the presence of turbidity. This method was repeated by changing phthalazine compounds with standard drugs Amoxicillin and Ketoconazole for comparison. The minimum inhibitory concentration at which no growth was observed was taken as the MIC value (Table 1). The comparison of the MICs (in µg/mL) of potent compounds and standard drugs against tested strains are presented in the Table 1.

Table 1: Antimicrobial activity of compounds **4a-j**

Compounds	Minimum inhibitory concentration (MIC) in µg/mL					
	Bacterial strains				Fungal strains	
	S. aureus	*B. subtilis*	*S. typhi*	*E. coli*	*A. niger*	*C. albican*
4a	500	-	250	250	-	500
4b	250	50	100	100	100	250
4c	50	50	25	25	100	62.5
4d	25	25	50	50	62.5	100
4e	12.5	12.5	25	12.5	62.5	62.5
4f	12.5	25	25	50	62.5	125
4g	50	25	50	50	125	125
4h	500	500	-	500	-	-
4i	25	25	12.5	50	62.5	62.5
4j	250	200	200	250	100	125
Amoxicillin	6.25	6.25	6.25	6.25	-	-
Ketaconazole	-	-	-	-	31.25	31.25

4. Conclusions

We reported here the successful synthesis of a series of some new 1,3-selenazoles substituted phthalazin-1(2H)-one derivatives. Most of the newly synthesized compounds were tested for their antimicrobial activity. The antimicrobial activity study revealed that all the compounds tested showed moderate to good antibacterial and antifungal activities against pathogenic strains.

Acknowledgements

This work was financially supported by the project "CEITEC– Central European Institute of Technology – excellent teams (CZ.1.07/2.3.00/30.0005)" financed from European Social Fund.

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2/13/2014