Synthesis of novel symmetrical and unsymmetrical bis-spiro[indole-indazolyl-thiazolidine]-2,4′-diones

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Abstract

A facile synthesis of novel symmetrical and unsymmetrical bis-[spiro(indole-indazolyl-thiazolidine)-2,4′-diones] **5a-f** has been achieved *via* hitherto unknown bis-Schiff bases **3a-f**, which in turn have been prepared from the earlier reported (1*H*-indol-2,3-dione)-1,1′-(1,6-hexanediyl)bis **1a-c** and 5-substituted-1-[6-(2,3-dioxoindolyl)hexyl]-1*H*-indol-2,3-diones **1d-f**.

Keywords: Bis-indolylimines, spiro[indole-thiazolidine], 1,3-dipolar cycloaddition

Introduction

The spiro[indole-thiazolidine] system is a structural motif that is present in many pharmacologically important synthetic and naturally occurring compounds (as typified by spirobrassinin).[1] The diversity of their biological functions [2,3] such as, anti-inflammatory, antimicrobial, antileukemic and anticonvulsant activities, has stimulated efforts in the expedient development of their synthesis. One of the best routes for their synthesis is by carrying out 1,3-dipolar cycloadditions on indolylimines.[4]

However, not much has been reported in the literature about bis counterparts of these spiro indoles. Considering this, and keeping our interest in spiroindoles alive,[4-6] we have earlier reported one such system, bis-[spiro(indole-pyrazolinyl-thiazolidine)-2,4′-dione], containing symmetrically[7] and unsymmetrically[8] substituted indoles. We now wish to report a facile synthesis of novel symmetrical and unsymmetrical bis-[spiro(indole-indazolyl-thiazolidine)-2,4′-diones] *via* hitherto unknown bis-indolylimines.

Results and Discussion

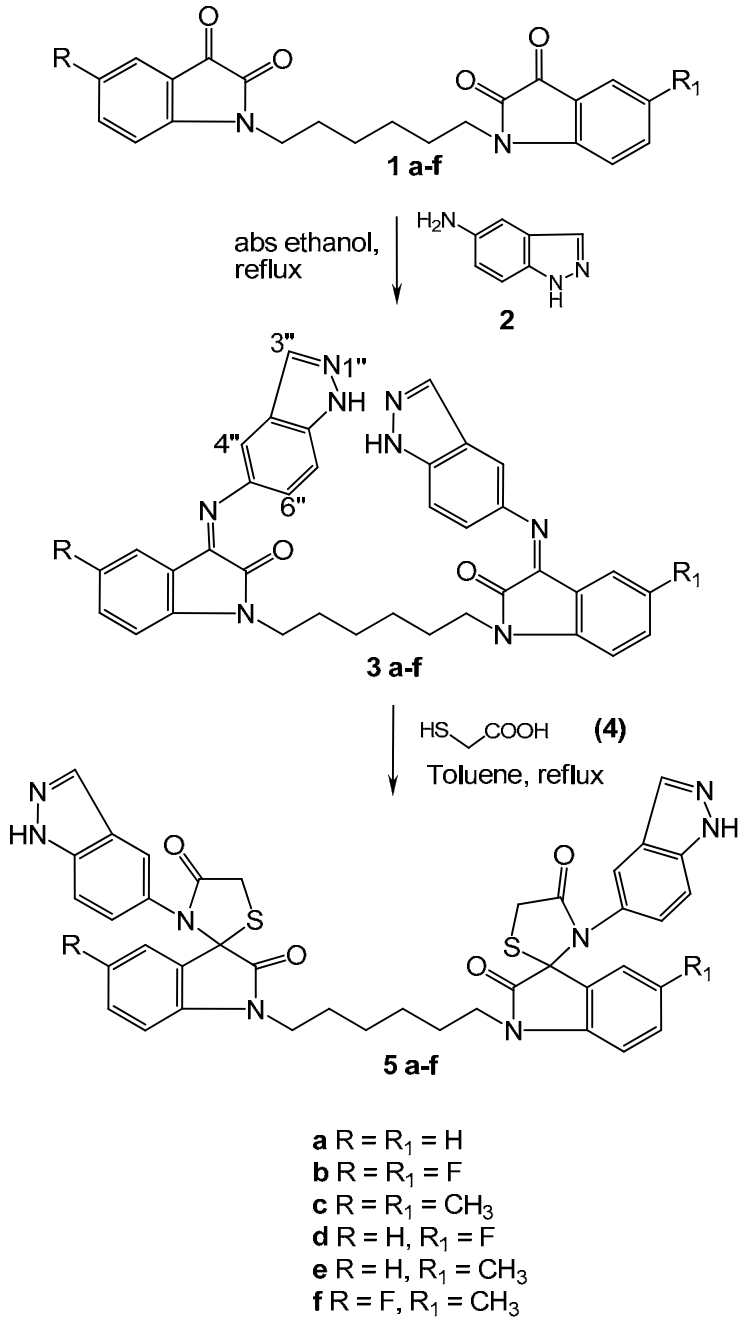
In our comprehensive plan for developing new bis spiroindoles, a series of novel symmetrical and unsymmetrical [3′-(indazol-5-yl)spiro(3*H*-indol-3,2′-thiazolidine)-2,4′-diones]-1,1′-(1,6-

hexanediyl)bis **5a-f** have now been synthesized from previously reported[7,8] (1*H*-indol-2,3-diones)-1,1′-(1,6-hexanediyl)bis **1a-c** and 5-substituted-1-[6-(2,3-dioxoindolyl)hexyl]-1*H*-indol-2,3-diones **1d-f** *via* hitherto unknown [3-(indazol-5-yl)imino-1*H*-indol-2-one]-1,1′-(1,6-hexanediyl)bis **3a-f** (Scheme 1).

The reaction of (1*H*-indol-2,3-dione)-1,1′-(1,6-hexanediyl)bis **1a** with 5-aminoindazole **2** in a 1:2 ratio in absolute ethanol yielded a yellow solid **3a**. Its mass spectrum showed a molecular ion peak at *m/z* 606, indicating that the two indazole moieties have coupled with **1a** with the loss of two water molecules. Its IR spectrum showed a characteristic absorption band at 1647 cm^{-1} for >C=N- thus indicating the formation of a Schiff′s base. Its ^{1}H NMR spectrum displayed peaks at δ 6.65 (4H), δ 7.06 (4H), δ 7.35 (4H), δ 7.63 (2H) and 8.02 (2H) showing the presence of aromatic protons of the indole and indazole moieties. Further, a broad singlet at δ 13.08 integrating for the two protons of the two indazole –NH moieties was also observed. The downfield triplet at δ 3.78 integrating for four protons showed the presence of two >N-CH_2- units. Besides these, the other methylenes of the hexyl spacer appeared at δ 1.70 & 1.48. The ^{13}C NMR spectrum of **3a** displayed a characteristic carbonyl carbon signal at δ 162.7 (C-2) in addition to a signal at δ 147.3 confirming the presence of a C=N at C-3 in the molecule. The above spectral studies confirmed the formation of bis Schiff's base **3a** which was characterized as [3-(indazol-5-yl) imino-1*H*-indol-2-one]-1,1′-(1,6-hexanediyl)bis.

The cyclocondensation of **3a** with mercaptoacetic acid **4** under refluxing conditions using a Dean-Stark apparatus afforded **5a** which showed a molecular ion peak at *m/z* 754. Its IR spectrum did not display any absorption in the region which could be due to >C=N but showed characteristic absorptions at 1721 (thiazolidinone carbonyl) and 1674 (indole carbonyl) cm^{-1}, thereby indicating that a cyclocondensation had taken place. This was fully supported by its ^{1}H NMR spectrum which displayed two characteristic multiplets at δ 3.86 & 4.13 for the two methylenes of the thiazolidinone rings. The rest of the protons of the indole, indazole and the hexyl spacer were observed at the usual positions with the expected integrations. The above spectral data convincingly characterized compound **5a** as [3′-(indazol-5-yl)spiro(3*H*-indol-3,2′-thiazolidine)-2,4′-dione]-1,1′-(1,6-hexanediyl)bis.

The above reactions were repeated using various symmetrically and unsymmetrically substituted bis-1*H*-indol-2,3-diones and the corresponding bis Schiff′s bases and bis spiro compounds have been obtained, which were fully characterized by studying their spectral data (Scheme 1).



Scheme 1

Experimental Section

General Procedures. Melting points were determined in a capillary tube in a sulphuric acid bath and are uncorrected. IR spectra were recorded on a Shimadzu model IR-435 spectrophotometer using KBr discs. ^{1}H NMR spectra were recorded on a Bruker AC (300 MHz) in DMSO-d_6. ^{13}C NMR were recorded on a Bruker AC (75.47 MHz) in DMSO-d_6. Elemental analyses were performed on a Perkin Elmer series 11, CHNS/O analyzer 2400. Mass spectra were recorded on

a Jeol-JMS-DX 303 mass spectrometer. Bis-indol-2,3-diones **1a-f** were prepared by earlier reported procedures[7,8] starting from the corresponding 1*H*-indol-2,3-diones synthesized by a literature procedure[6]. 5-Aminoindazole was procured from the Aldrich Chemical Co.

[3-(Indazol-5-yl)imino-1*H*-indol-2-one]-1,1′-(1,6-hexanediyl)bis (3a). A mixture of (1*H*-indol-2,3-dione)-1,1′-(1,6-hexanediyl)bis **1a** (376 mg, 1 mmol) and 5-aminoindazole **2** (266 mg, 2 mmol) was refluxed in absolute ethanol (30 ml) for 6 hours. The compound that separated out on cooling was filtered, washed with ethanol and crystallized from chloroform/methanol as yellow solid **3a**. Yield 90%, m.p. 142-143°C; IR(KBr) cm^{-1}: 3275, 2924, 2853, 1723, 1647, 1604, 1465, 1375, 1289, 1167, 1102, 946, 809, 752; ^{1}H NMR (δ, DMSO-d_6): 13.08 (s, 2H, 2x>NH-indazole), 8.02 (s, 2H, 2xH-3″), 7.63 (m, 2H, 2xH-6″), 7.35 (m, 4H, 2x(H-4 & H-4″)), 7.06 (m, 4H, 2x(H-6 & H-7″)), 6.65 (m, 4H, 2x(H-5 & H-7)), 3.78 (t, 4H, *J* = 6.4 Hz, 2xH-1′), 1.70 & 1.48 (2m, 8H, 2x(H-2′ & H-3′)); ^{13}C NMR (δ, DMSO-d_6): 162.7(C-2), 154.3, 147.3(C-3), 143.3, 138.5, 134.2, 133.9, 125.2, 123.4, 122.8, 118.9, 115.6, 111.5, 110.2, 108.2, 40.6(C-1′), 27.1(C-2′), 26.3(C-3′); EIMS, *m/z*: 606 (M^+, 85), 490 (100), 398 (22), 376 (28), 348 (12), 330 (6). Anal. Calcd for $C_{36}H_{30}N_8O_2$: C, 71.27; H, 4.98; N, 18.47. Found: C, 71.38; H, 4.95; N, 18.49.

Compounds **3b-f** were also synthesised using the above procedure.

[3-(Indazol-5-yl)imino-5-fluoro-1*H*-indol-2-one]-1,1′-(1,6-hexanediyl)bis (3b). Yield 85%, m.p. 159-160°C; IR(KBr) cm^{-1}: 3354, 2921, 2850, 1722, 1638, 1611, 1463, 1344, 1250, 1126, 942, 806, 754; ^{1}H NMR (δ, DMSO-d_6): 13.17 (s, 2H, 2x>NH-indazole), 8.07 (s, 2H, 2xH-3″), 7.65 (m, 2H, 2xH-6″), 7.39 (m, 4H, 2x(H-4 & H-4″)), 7.08 (m, 4H, 2x(H-6 & H-7″)), 6.25 (m, 2H, 2xH-7)), 3.65 (m, 4H, 2xH-1′), 1.65 & 1.44 (2m, 8H, 2x(H-2′ & H-3′)); EIMS, *m/z*: 642 (M^+, 8), 580 (4), 548 (14), 526 (100), 465 (34), 434 (52), 426 (12), 398 (5), 366 (3), 235 (4), 203 (5). Anal. Calcd for $C_{36}H_{28}F_2N_8O_2$: C, 67.28; H, 4.39; N, 17.44. Found: C, 67.36; H, 4.33; N, 17.48.

[3-(Indazol-5-yl)imino-5-methyl-1*H*-indol-2-one]-1,1′-(1,6-hexanediyl)bis (3c). Yield 80%, m.p. 190-191°C; IR(KBr) cm^{-1}: 3234, 2924, 2854, 1710, 1640, 1619, 1493, 1462, 1377, 1161, 944, 808; ^{1}H NMR (δ, DMSO-d_6): 12.97 (s, 2H, 2x>NH-indazole), 7.94 (s, 2H, 2xH-3″), 7.56 (m, 2H, 2xH-6″), 7.41 (s, 2H, 2xH-4″), 7.04 (m, 4H, 2x(H-6 & H-7″)), 6.65 (s, 2H, 2xH-4), 6.32 (m, 2H, 2xH-7), 3.70 (m, 4H, 2xH-1′), 2.24 (s, 6H, 2x5-CH_3), 1.88 & 1.64 (2m, 8H, 2x(H-2′ & H-3′)); EIMS, *m/z*: 634 (M^+, 12), 518 (90), 404 (22), 390 (14), 227 (18). Anal. Calcd for $C_{38}H_{34}N_8O_2$: C, 71.91; H, 5.40; N, 17.65. Found: C, 71.82; H, 5.36; N, 17.69.

5-Fluoro-1-[6-{3-(indazol-5-yl)imino-2-oxo-indolyl}hexyl]-3-(indazol-5-yl)imino-1*H*-indol-2-one (3d). Yield 76%, m.p. 130-132°C; IR(KBr) cm^{-1}: 3354, 2924, 2855, 1712, 1710, 1651, 1602, 1461, 1376, 1159, 944, 723; ^{1}H NMR (δ, DMSO-d_6): 13.15 (s, 2H, 2x>NH-indazole), 7.95 & 7.89 (2s, 2H, 2xH-3″), 7.51 (m, 2H, 2xH-6″), 7.33 & 7.24 (2m, 6H, 2x(H-4, H-6 & H-4″)), 6.79 (m, 2H, 2xH-7″), 6.63 & 6.36 (2m, 3H, H-5 & 2xH-7), 3.72 (m, 4H, 2xH-1′), 1.67 & 1.43 (m, 8H, 2x(H-2′ & H-3′)); ^{13}C NMR (δ, DMSO-d_6): 162.7 & 162.6(2xC-2), 154.3, 147.4 & 147.3(2xC-3), 143.3-108.2(aromatic carbons), 40.3 & 40.2(2xC-1′), 27.1 & 27.0(2xC-2′), 26.2 & 26.0(2xC-3′); EIMS, *m/z*: 624 (M^+, 4), 594 (20), 506 (10), 474 (26), 450 (4), 418 (98), 394

(20), 362 (8), 334 (22), 304 (2), 276 (5), 250 (52), 232 (16), 202 (10), 177 (18), 162 (84), 133 (92), 120 (66), 91 (38), 77 (34). Anal. Calcd for $C_{36}H_{29}FN_8O_2$: C, 69.22; H, 4.68; N, 17.94. Found: C, 69.30; H, 4.62; N, 17.98.

5-Methyl-1-[6-{3-(indazol-5-yl)imino-2-oxo-indolyl}hexyl]-3-(indazol-5-yl)imino-1*H*-indol-2-one (3e). Yield 75%, m.p. 158-159°C; IR(KBr) cm^{-1}: 3217, 2924, 2854, 1716, 1632, 1606, 1484, 1465, 1377, 1290, 1213, 1163, 1103, 944, 880, 814, 749; ^{1}H NMR (δ, DMSO-d_6): 12.73 (s, 2H, 2x>NH-indazole), 8.05 (s, 2H, 2xH-3′′), 7.58 (m, 2H, 2xH-6′′), 7.38 (m, 2H, 2xH-4′′), 7.06 (m, 2H, 2xH-6), 6.89 (m, 2H, 2xH-7′′), 6.76, 6.56 & 6.49 (3m, 5H, H-5, 2x(H-4 & H-7)), 3.76 (m, 4H, 2xH-1′), 2.25 (s, 3H, 5-CH_3), 1.67 (m, 4H, 2xH-2′), 1.47 (m, 4H, 2xH-3′); EIMS, *m/z*: 620 (M^+, 6), 505 (18), 419 (10), 335 (2), 261 (28), 247 (12), 146 (8), 133 (100). Anal. Calcd for $C_{37}H_{32}N_8O_2$: C, 71.60; H, 5.20; N, 18.05. Found: C, 71.72; H, 5.16; N, 17.80.

5-Fluoro-1-[6-{5-methyl-3-(indazol-5-yl)imino-2-oxo-indolyl}hexyl]-3-(indazol-5-yl) imino-1*H*-indol-2-one (3f). Yield 66%, m.p. 165-167°C; IR(KBr) cm^{-1}: 3224, 2924, 2855, 1712, 1631, 1612, 1462, 1377, 1160, 944, 815, 722; ^{1}H NMR (δ, DMSO-d_6): 12.54 (s, 2H, 2x>NH-indazole), 8.01 (s, 2H, 2xH-3′′), 7.63 (m, 2H, 2xH-6′′), 7.09 (m, 2H, 2xH-6), 6.96 (m, 2H, 2xH-7′′), 7.35, 6.86, 6.53 & 6.44 (4m, 6H, 2x(H-4′′, H-4 & H-7), 3.80 (m, 4H, 2xH-1′), 2.18 (s, 3H, 5-CH_3), 1.71 (m, 4H, 2xH-2′), 1.49 (m, 4H, 2xH-3′); EIMS, *m/z*: 638 (M^+, 2), 552 (4), 523 (18), 505 (20), 446 (22), 408 (6), 367 (18), 323 (20), 268 (64), 239 (34). Anal. Calcd for $C_{37}H_{31}FN_8O_2$: C, 69.58; H, 4.89; N, 17.54. Found: C, 69.67; H, 4.84; N, 17.60.

[3′-(Indazol-5-yl)spiro(3*H*-indol-3,2′-thiazolidine)-2,4′-dione]-1,1′-(1,6-hexanediyl)bis (5a). A mixture of **3a** (121 mg, 0.2 mmol) and mercaptoacetic acid **4** (46 mg, 0.5 mmol) was taken in dry toluene in a round-bottom flask fitted with a Dean Stark apparatus. The contents were refluxed for 8 hours with simultaneous removal of water azeotropically. A sticky solid was formed on removing toluene under reduced pressure and was treated with a saturated solution of sodium bicarbonate to remove excess acid. The solid left was filtered, washed with water, dried and was crystallized from chloroform/methanol as white solid **5a**. Yield 65%, m.p. 124-126°C; IR(KBr) cm^{-1}: 3273, 2924, 2854, 1721, 1674, 1613, 1487, 1465, 1376, 1210, 1157, 1112, 940, 800, 750; ^{1}H NMR (δ, DMSO-d_6): 12.97 (s, 2H, 2x>NH-indazole), 7.85 (s, 2H, 2xH-3′′), 7.57 (m, 2H, 2xH-6′′), 7.25 (m, 4H, 2x(H-4 & H-4′′)), 7.03 (m, 2H, 2xH-6), 6.90 (m, 2H, 2xH-7′′), 6.76 (m, 4H, 2x(H-5 & H-7)), 4.13 & 3.86 (2d, 4H, J = 15.2 Hz each, 2xS-CH_2), 3.68 (m, 4H, 2xH-1′), 1.62 & 1.37 (2m, 8H, 2x(H-2′ & H-3′)); ^{13}C NMR (δ, DMSO-d_6): 174.1 (SCH_2**CO**), 172.3 (C-2), 142.0, 136.9, 132.8, 133.2, 130.4, 127.9, 126.4, 125.1, 123.9, 121.4, 120.4, 110.4, 109.8, 69.4 (C-3), 40.8 (C-1′), 32.7 (SCH_2), 26.9 (C-2′), 26.1 (C-3′); EIMS, *m/z*: 754 (M^+, 16), 618 (6), 602 (12), 586 (85), 412 (42), 398 (18), 333 (8), 300 (32), 234 (4), 214 (4). Anal. Calcd for $C_{40}H_{34}N_8O_4S_2$: C, 63.64; H, 4.54; N, 14.84. Found: C, 63.52; H, 4.51; N, 15.22.

Compounds **5b-f** were also synthesised using the above mentioned procedure.

[3′-(Indazol-5-yl)spiro(5-fluoro-3*H*-indol-3,2′-thiazolidine)-2,4′-dione]-1,1′-(1,6-hexanediyl) bis (5b). Yield 63%, m.p. 133-134°C; IR(KBr) cm^{-1}: 3373, 2924, 2855, 1725, 1610, 1461, 1377, 1248, 1125, 940, 800, 752; ^{1}H NMR (δ, DMSO-d_6): 12.98 (s, 2H, 2x>NH-indazole), 7.92 (s, 2H, 2xH-3′′), 7.49 (m, 2H, 2xH-6′′), 7.38 (m, 4H, 2x(H-4 & H-4′′)), 6.99 (m, 4H, 2x(H-6 & H-7′′)),

6.80 (m, 2H, 2xH-7), 4.18 & 3.95 (2d, 4H, *J* = 15.0 Hz each, 2xS-CH_2), 3.68 (m, 4H, 2xH-1′), 1.61 & 1.41 (2m, 8H, 2x(H-2′ & H-3′)); EIMS, *m/z*: 790 (M^+, 84), 753 (4), 713 (3), 638 (8), 609 (6), 508 (10), 478 (8), 420 (5), 317 (4). Anal. Calcd for $C_{40}H_{32}F_2N_8O_4S_2$: C, 60.75; H, 4.08; N, 14.17. Found: C, 60.90; H, 4.03; N, 14.25.

[3′-(Indazol-5-yl)spiro(5-methyl-3*H*-indol-3,2′-thiazolidine)-2,4′-dione]-1,1′-(1,6-hexanediyl) bis (5c). Yield 65%, m.p. 156-157°C; IR(KBr) cm^{-1}: 2924, 2850, 1718, 1673, 1627, 1495, 1456, 1348, 1308, 1180, 1141, 902, 814, 696, 636, 590; ^{1}H NMR (δ, DMSO-d_6): 13.01 (s, 2H, 2x>NH, indazole), 8.04 (s, 2H, 2xH-3′′), 7.53 (m, 2H, 2xH-6′′), 7.42 & 7.11 (2m, 8H, 2x(H-4′′, H-7′′, H-4 & H-6)), 6.62 (m, 2H, 2xH-7)**,** 4.12 and 3.87 (2d, 2H, *J* = 15.5 Hz each, 2xS-CH_2), 3.64 (m, 4H, 2xH-1′), 2.12 (s, 6H, 2x5-CH_3), 1.68 & 1.40 (2m, 8H, 2x(H-2′ & H-3′)); EIMS, *m/z*: 782 (M^+, 10), 754 (30), 726 (18), 708 (10), 662 (20), 634 (24), 526 (32), 404 (40). Anal. Calcd for $C_{42}H_{38}N_8O_4S_2$: C, 64.43; H, 4.89; N, 14.31. Found: C, 64.60; H, 4.84; N, 14.40.

5-Fluoro-1-[6-{3′-(indazol-5-yl)spiro(3*H*-indol-3,2′-thiazolidine)-2,4′-dione-1-yl}hexyl]-3′-(indazol-5-yl) spiro(3*H*-indol-3,2′-thiazolidine)-2,4′-dione (5d). Yield 58%, m.p. 142-143°C; IR(KBr) cm^{-1}: 3304, 2924, 2854, 1711, 1689, 1610, 1463, 1375, 1250, 1125, 1050, 900, 854, 752; ^{1}H NMR (δ, DMSO-d_6): 12.81 (s, 2H, 2x>NH-indazole), 7.90 (s, 2H, 2xH-3′′), 7.63 (m, 2H, 2xH-6′′), 7.43 (m, 2H, 2x H-4′′), 7.39 (m, 2H, 2xH-4), 7.24 (m, 2H, 2xH-6), 6.93 (m, 2H, 2xH-7′′), 6.82 (m, 3H, H-5, 2xH-7), 4.19 & 3.94 (2d, 4H, *J* = 15.6 Hz each, 2xS-CH_2), 3.74 (m, 4H, 2xH-1′), 1.64 & 1.28 (2m, 8H, 2x(H-2′ & H-3′)); ^{13}C NMR (δ, DMSO-d_6): 174.9 & 174.8 (2xSCH_2**CO**), 172.4 & 172.2 (2xC-2), 148.9-109.7(aromatic carbons), 69.5 & 69.4 (2xC-3), 40.6 & 40.5 (2xC-1′), 32.6 & 32.4 (2xSCH_2), 26.9 & 26.6 (2xC-2′), 25.7 & 25.6 (2xC-3′); EIMS, *m/z*: 772 (M^+, 20), 735 (8), 689 (6), 659 (41), 646 (9), 619 (7), 604 (79), 415 (100), 390 (25), 238 (12). Anal. Calcd for $C_{40}H_{33}FN_8O_4S_2$: C, 62.16; H, 4.30; N, 14.50. Found: C, 62.23; H, 4.23; N, 14.57.

5-Methyl-1-[6-{3′-(indazol-5-yl)spiro(3*H*-indol-3,2′-thiazolidine)-2,4′-dione-1-yl}hexyl]-3′-(indazol-5-yl) spiro(3*H*-indol-3,2′-thiazolidine)-2,4′-dione (5e). Yield 52%, m.p. 147-148°C; IR(KBr) cm^{-1}: 3323, 2921, 2850, 1714, 1686, 1608, 1458, 1371, 848, 751; ^{1}H NMR (δ, DMSO-d_6): 12.92 (s, 2H, 2x>NH-indazole), 8.05 (s, 2H, 2xH-3′′), 7.62 (m, 2H, 2xH-6′′), 7.42(m, 2H, 2x H-4′′), 7.35, 7.03, 6.96, 6.74 & 6.66 (5m, 9H, H-5 & 2x(H-4, H-6, H-7 & H-7′′)), 4.22 & 3.92 (2d, 4H, *J* = 15.9 Hz each, 2xS-CH_2), 3.75 (m, 4H, 2x H-1′), 2.33 (s, 3H, 5-CH_3), 1.67 (m, 4H, 2x H-2′), 1.43 (m, 4H, 2x H-3′); EIMS, *m/z*: 768 (M^+, 10), 694 (15), 620 (80), 549 (32), 390 (18), 146 (28). Anal. Calcd for $C_{41}H_{36}N_8O_4S_2$: C, 64.04; H, 4.72; N, 14.57. Found: C, 64.12; H, 4.67; N, 14.63.

5-Fluoro-1-[6-{3′-(indazol-5-yl)spiro(5-methyl-3*H*-indol-3,2′-thiazolidine)-2,4′-dione-1-yl}hexyl]-3′-(indazol-5-yl) spiro(3*H*-indol-3,2′-thiazolidine)-2,4′-dione (5f). Yield 54%, m.p. 178-179°C; IR(KBr) cm^{-1}: 3324, 2924, 2854, 1721, 1682, 1627, 1462, 1377, 1334, 1120, 1050, 780; ^{1}H NMR (δ, DMSO-d_6): 12.91 (s, 2H, 2x->NH-indazole), 8.11 (s, 2H, 2xH-3′′), 7.64 (m, 2H, 2xH-6′′), 7.39 (s, 2H, 2xH-4′′), 7.18, 6.96, 6.89 & 6.79 (4m, 8H, 2x(H-4, H-6, H-7 & H-7′′)), 4.05 & 3.95 (2d, 4H, *J* = 15.6 Hz each, 2xS-CH_2), 3.80 (m, 4H, 2xH-1′), 2.31 (s, 3H, 5-CH_3), 1.62 & 1.37 (m, 8H, 2x(H-2′ & H-3′)); EIMS, *m/z*: 786 (M^+, 12), 772 (8), 758 (16), 712

(32), 699 (16), 638 (22), 498 (18), 390 (100). Anal. Calcd for $C_{41}H_{35}FN_8O_4S_2$: C, 62.58; H, 4.48; N, 14.24. Found: C, 62.76; H, 4.42; N, 14.32.

Acknowledgements

The authors thank CSIR, UGC and DST (New Delhi) for financial assistance.

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