Unprecedented formation of 2-oxaspiro[bicyclo[2.2.1]heptane-6,3'-indoline] derivatives from reaction of 3-phenacylideneoxindole with malononitrile or ethyl cyanoacetate

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Supporting Information

Figures 1-s3

1H and 13C NMR spectra of the obtained compounds
Fig. s1 Molecular structure of spiro compound 1e (major isomer)

Fig. s2 Molecular structure of spiro compound 1i (major isomer)

Fig. s3 Molecular structure of spiro compound 3d
1'-benzyl-7-(1-benzyl-2-oxindolin-3-yl)-3-imino-1-(4-methylphenyl)-5-(4-methylbenzoyl)-2'-oxo-2-oxaspiro[bicyclo[2.2.1]heptane-6,3'-indoline]-4-carbonitrile (1a):
1'-benzyl-7-(1-benzyl-5-methyl-2-oxoindolin-3-yl)-3-imino-1-(4-methylphenyl)-5'-methyl-5-(4-methylbenzoyl)-2'-oxo-2-oxaspiro[bicyclo[2.2.1]heptane-6,3'-indoline]-4-carbonitrile (1b):
1'-benzyl-7-(1-benzyl-5-fluoro-2-oxoindolin-3-yl)-5'-fluoro-3-imino-1-(4-methylphenyl)-5-(4-methylbenzoyl)-2'-oxo-2-oxaspiro[bicyclo[2.2.1]heptane-6,3'-indoline]-4-carbonitrile (1c):
5-benzoyl-1'-benzyl-7-(1-benzyl-5-fluoro-2-oxoindolin-3-yl)-5'-fluoro-3-imino-1-phenyl-2'-oxo-2-oxaspiro[bicyclo[2.2.1]heptane-6,3'-indoline]-4-carbonitrile (1d):
1'-benzyl-7-(1-benzyl-5-chloro-2-oxoindolin-3-yl)-5'-chloro-5-(4-chlorobenzoyl)-1-(4-chlorophenyl)-3-imino-2'-oxo-2-oxaspiro[bicyclo[2.2.1]heptane-6,3'-indoline]-4-carbonitrile (1e):
1'-butyl-7-(1-butyl-5-fluoro-2-oxoindolin-3-yl)-5'-fluoro-3-imino-1-(4-methoxyphenyl)-5-(4-methoxybenzoyl)-2'-oxo-2-oxaspiro[bicyclo[2.2.1]heptane-6,3'-indoline]-4-carbonitrile (1f):
1'-butyl-7-(1-butyl-5-chloro-2-oxoindolin-3-yl)-5'-chloro-3-imino-1-(4-methoxyphenyl)-5-(4-methoxybenzoyl)-2'-oxo-2-oxaspiro[bicyclo[2.2.1]heptane-6,3'-indoline]-4-carbonitrile (1g):
1'-butyl-7-(1-butyl-5-chloro-2-oxoindolin-3-yl)-5'-chloro-5-(4-chlorobenzoyl)-1-(4-chlorophenyl)-3-imino-2'-oxo-2-oxaspiro[bicyclo[2.2.1]heptane-6,3'-'indoline]-4-carbonitrile (1h):
Ethyl 1'-benzyl-7-(1-benzyl-2-oxoindolin-3-yl)-3-imino-1-(methylphenyl)-5-(4-methylbenzoyl)-2'-oxo-2-oxaspiro[2.2.1]heptane-6,3'-indoline]-4-carboxylate (1i):
ethyl 1'-benzyl-7-(1-benzyl-5-fluoro-2-oxoindolin-3-y1)-5'-fluoro-3-imino-1-(4-methylphenyl)-5-(4-methylbenzoyl)-2'-oxo-2-oxaspiro[bicyclo[2.2.1]heptane-
6,3’-indoline]-4-carboxylate (1j):
ethyl 1'-benzyl-7-(1-benzyl-5-chloro-2-oxoindolin-3-yl)-5'-chloro-3-imino-1-(4-methylphenyl)-5-(4-methylbenzoyl)-2'-oxo-2-oxaspiro[bicyclo[2.2.1]heptane-
6,3'-indoline]-4-carboxylate (1k):
Ethyl 2-(1-benzyl-2-oxoindolin-3-yl)-3,3-dicyanopropanoate (2):
4-(1-benzyl-2-oxoindolin-3-yl)-5-hydroxy-2-oxo-5-phenylpyrrolidine-3-carbonitrile (3a):
4-(1-benzyl-2-oxoindolin-3-yl)-5-(4-chlorophenyl)-5-hydroxy-2-oxopyrrolidine-3-carbonitrile (3b):
4-(1-benzyl-5-methyl-2-oxoindolin-3-yl)-5-hydroxy-2-oxo-5-p-tolylpyrrolidine-3-carbonitrile (3c):
4-(1-benzyl-5-methyl-2-oxoindolin-3-yl)-5-(4-chlorophenyl)-5-hydroxy-2-oxopyrrolidine-3-carbonitrile (3d):
4-(1-benzyl-5-fluoro-2-oxoindolin-3-yl)-5-hydroxy-2-oxo-5-p-tolylpyrrolidine-3-carbonitrile (3e):
4-(1-butyl-5-chloro-2-oxoindolin-3-yl)-5-hydroxy-5-(4-methoxyphenyl)-2-oxopyrrolidine-3-carbonitrile (3f):