

"DERIVATIVES OF N-PHENYLPYRAZOLES"

This invention relates to N-phenylpyrazole derivatives, to compositions containing them and to the use of N-phenylpyrazole derivatives against arthropod, plant nematode, helminth and protozoan pests.

5 The present invention provides N-phenylpyrazole derivatives of the general formula (I) depicted hereinafter wherein R^1 represents a cyano or nitro group, a halogen, i.e. fluorine, chlorine, bromine or iodine, atom, or an acetyl or formyl group; R^2 represents a group R^5SO_2 , R^5SO , or R^5S in which R^5 represents a
10 straight or branched chain alkyl, alkenyl or alkynyl (preferably 1-(alkynyl)alkyl and more preferably alk-2-ynyl) group containing up to 4 carbon atoms which may be unsubstituted or substituted by one or more
15 halogen atoms which may be the same or different; R^3 represents a hydrogen atom, or an amino group $-NR^6R^7$ wherein R^6 and R^7 , which may be the same or different, each represent a hydrogen atom or a straight or branched chain alkyl, alkenylalkyl or alkynylalkyl
20 group containing up to 5 carbon atoms, a formyl group, a straight or branched chain alkanoyl group (which contains from 2 to 5 carbon atoms and which may be optionally substituted by one or more halogen atoms) or R^6 and R^7 together with the nitrogen atom to which
25 they are attached form a 5 or 6 membered cyclic imide,

or represents a straight or branched-chain
alkoxycarbonyl group (which contains from 2 to 5 carbon
atoms and is unsubstituted or substituted by one or
more halogen atoms), or R³ represents a straight or
5 branched-chain alkoxymethyleneamino group containing
from 2 to 5 carbon atoms which may be unsubstituted or
substituted on methylene by a straight or
branched-chain alkyl group containing from 1 to 4
carbon atoms, or represents a halogen, i.e. fluorine,
10 chlorine, bromine or iodine, atom; and R⁴ represents a
phenyl group substituted in the 2-position by a
fluorine, chlorine, bromine or iodine atom; in the
4-position by a straight or branched chain alkyl or
alkoxy group containing from 1 to 4 carbon atoms which
15 may be unsubstituted or substituted by one or more
halogen atoms which may be the same or different (the
trifluoromethyl and trifluoromethoxy groups are
preferred), or a chlorine or bromine atom; and
optionally in the 6-position by a fluorine, chlorine,
20 bromine or iodine atom, with the exclusion of the
compound wherein R¹ represents cyano, R² represents
methanesulphonyl, R³ represents amino and R⁴ represents
2,6-dichloro-4-trifluoromethylphenyl, which have
valuable activity against arthropod, plant nematode,
25 helminth and protozoan pests, more particularly by

ingestion of the compound(s) of general formula I by the arthropods.

Compounds of general formula (I), processes for their preparation, compositions containing them and
5 methods for their use constitute features of the present invention.

It is to be understood that the halogen atoms on the phenyl group R^4 may be the same or different. When groups are substituted by more than one halogen atom it
10 is to be understood that the halogen atoms may be the same or different.

Preferred compounds of general formula (I) are those wherein R^2 represents an alkylsulphonyl/sulphinyl/thio group which is optionally
15 halogen substituted containing from 1 to 4 carbon atoms, or an alkenyl- or alkynyl-sulphonyl/sulphinyl/thio group which is optionally halogen substituted and contains up to 4 carbon atoms, preferably a trifluoromethylthio or
20 trifluoromethylsulphinyl group, R^3 represents the hydrogen atom, an amino or methylamino group and R^1 represents a halogen atom or preferably the cyano or nitro group.

Compounds of general formula (I) wherein R^4 contains the trifluoromethyl or trifluoromethoxy group, and R^2 represents an optionally halogenated alkylsulphonyl/sulphinyl/thio group containing from 1 to 4 carbon atoms are preferred. Trifluoromethylthio, trifluoromethylsulphinyl and trifluoromethanesulphonyl are especially preferred for R^2 .

Preferred compounds of general formula (I) are those with phenyl (R^4) substitution which is 2,4,6-trichloro, 2,6-dichloro-4-difluoromethoxy, 2-chloro-4-trifluoromethyl, 2-bromo-6-chloro-4-trifluoromethyl, 2,6-dibromo-4-trifluoromethyl or 2-bromo-4-trifluoromethyl.

Compounds of general formula (I) with 2,6-dichloro-4-trifluoromethyl or 2,6-dichloro-4-trifluoromethoxy substitution of the phenyl group (R^4) are especially preferred.

Compounds of general formula (I) which are of particular interest are:

1. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole.
- 5 2. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethoxyphenyl)-4-trifluoromethylthiopyrazole.
3. 5-Amino-3-cyano-1-(2,6-dichloro-4-difluoromethoxyphenyl)-4-trifluoromethylthiopyrazole.
4. 5-Amino-1-(2-chloro-4-trifluoromethyl-
10 phenyl)-3-cyano-4-trifluoromethylthiopyrazole.
5. 5-Amino-3-cyano-1-(2,4,6-trichlorophenyl)-4-trifluoromethylthiopyrazole.
6. 5-Amino-3-cyano-1-(2,6-dibromo-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole.
- 15 7. 5-Amino-1-(2-bromo-4-trifluoromethylphenyl)-3-cyano-4-trifluoromethylthiopyrazole.

8. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-difluoromethylthiopyrazole.
9. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-heptafluoropropylthiopyrazole.
- 5 10. 5-Amino-1-(2-bromo-6-chloro-4-trifluoromethylphenyl)-3-cyano-4-trifluoromethylthiopyrazole.
11. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trichloromethylthiopyrazole.
12. 5-Amino-3-chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole.
- 10 13. 5-Amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole.
14. 5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-fluoro-4-trifluoromethylthiopyrazole.
- 15 15. 5-Amino-4-chlorodifluoromethylthio-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole.
16. 5-Chloro-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole.
17. 5-Amino-3-chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole.
- 20 18. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-ethoxymethyleneamino-4-trifluoromethylthiopyrazole.
19. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-ethoxyethylideneamino-4-trifluoromethylthiopyrazole.
- 25 19. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-ethoxyethylideneamino-4-trifluoromethylthiopyrazole.

20. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-ethoxymethyleneamino-4-methanesulphonyl-pyrazole.
- 5 21. 5-Acetamido-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole.
22. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-bis(propionyl)amino-4-trifluoromethylthio-pyrazole.
- 10 23. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-propionamido-4-trifluoromethylthiopyrazole.
24. 5-Acetamido-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole.
- 15 25. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-trifluoromethylthio-5-trimethylacetamido-pyrazole.
26. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-bis(methoxycarbonyl)amino-4-trifluoromethylthiopyrazole.
- 20 27. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-bis(ethoxycarbonyl)amino-4-trifluoromethylthiopyrazole.
28. 5-Chloroacetamido-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole.
- 25 29. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-bis(ethoxycarbonyl)amino-4-methanesulphonylpyrazole.

30. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-methanesulphonyl-5-trimethylacetamido-pyrazole.
31. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-dimethylamino-4-trifluoromethylthiopyrazole.
32. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-isopropylamino-4-trifluoromethylthiopyrazole.
33. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-propylamino-4-trifluoromethylthiopyrazole.
- 10 34. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-dipropylamino-4-trifluoromethylthiopyrazole.
35. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-bis(propargyl)amino-4-trifluoromethylthiopyrazole.
- 15 36. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-methylamino-4-methanesulphonylpyrazole.
37. 5-Bromo-3-cyano-1-(2,6-dichloro-4-trifluoroethylphenyl)-4-trifluoromethanesulphonylpyrazole.
38. 5-Bromo-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole.
- 20 39. 5-Bromo-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole.
40. 5-Amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole.
- 25 41. 3-Bromo-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-methanesulphonylpyrazole.

42. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-trifluoromethylthiopyrazole.
43. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-trifluoromethanesulphonylpyrazole.
- 5 44. 3-Cyano-1-(2,6-dichloro-4-trifluoromethoxy-phenyl)-4-trifluoromethylthiopyrazole.
45. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-methanesulphonylpyrazole.
46. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-iodo-4-trifluoromethylthiopyrazole.
- 10 47. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-iodo-4-trifluoromethanesulphonylpyrazole.
48. 5-Amino-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-3-iodo-4-methanesulphonylpyrazole.
- 15 49. 1-(2,6-Dichloro-4-trifluoromethylphenyl)-3-iodo-4-methanesulphonylpyrazole.
50. 1-(2,6-Dichloro-4-trifluoromethylphenyl)-3-iodo-4-trifluoromethylthiopyrazole.
51. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoro-methylphenyl)-4-trifluoromethanesulphonylpyrazole.
- 20 52. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoro-methylphenyl)-4-trifluoromethylsulphinylypyrazole.
53. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoro-methoxyphenyl)-4-trifluoromethanesulphonylpyrazole.
- 25 54. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoro-methoxyphenyl)-4-trifluoromethylsulphinylypyrazole.

55. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-trifluoromethylsulphonylpyrazole.
56. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4(1-methylprop-2-ynylsulphonyl)pyrazole.
- 5 57. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methylsulphonylpyrazole.
58. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-isopropylsulphonylpyrazole.
59. 5-Amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylsulphonylpyrazole.
- 10 60. 5-Amino-4-tert-butanesulphonyl-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole.
61. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-propylamino-4-trifluoromethylsulphonylpyrazole.
- 15 62. 5-Acetamido-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethanesulphonylpyrazole.
63. 1-(2,6-Dichloro-4-trifluoromethylphenyl)-4-methanesulphonyl-3-nitropyrazole.
- 20 64. 5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonyl-3-nitropyrazole.
65. 1-(2,6-Dichloro-4-trifluoromethylphenyl)-3-nitro-4-trifluoromethylsulphonylpyrazole.
66. 5-Amino-1-(2-bromo-6-chloro-4-trifluoromethylphenyl)-3-cyano-4-methanesulphonylpyrazole.
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67. 5-Amino-1-(2,6-dichloro-4-trifluoromethoxy-phenyl)-3-cyano-4-methanesulphonylpyrazole.
68. 3-Acetyl-5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole.
- 5 69. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methylthiopyrazole.
70. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-ethylthiopyrazole.
71. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-propylthiopyrazole.
- 10 72. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-isopropylthiopyrazole.
73. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-(2-methylpropylthio)pyrazole.
- 15 74. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-(1-methylpropylthio)pyrazole.
75. 4-Allylthio-5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole.
76. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-(prop-2-ynylthio)pyrazole.
- 20 77. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-(1-methylprop-2-ynylthio)pyrazole.
78. 5-Amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methylthiopyrazole.
- 25 79. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-tert-butylthiopyrazole.

80. 5-Amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methylsulphonylpyrazole.
81. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-ethanesulphonylpyrazole.
- 5 82. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-methylamino-4-trifluoromethylthiopyrazole.
83. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-(N-ethoxycarbonyl-N-methyl)amino-4-trifluoromethylthiopyrazole.
- 10 84. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-trifluoroacetamido-4-trifluoromethylthiopyrazole.
85. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-(ethoxycarbonylamino)-4-trifluoromethylthiopyrazole.
- 15 86. 3-Acetyl-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole.
87. 1-(2,6-Dichloro-4-trifluoromethylphenyl)-3-formyl-4-trifluoromethylthiopyrazole.
- 20 88. 5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-formyl-4-trifluoromethylthiopyrazole.
89. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-fluoro-4-trifluoromethanesulphonylpyrazole.
90. 5-Amino-3-cyano-4-dichlorofluoromethylthio-25 1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole.

91. 5-Amino-3-chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethanesulphonylpyrazole.
92. 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-pentafluoroethylthiopyrazole.
- 5 93. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-dimethylamino-4-trifluoromethylsulphonylpyrazole.
94. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-iodo-4-trifluoromethylsulphonylpyrazole.
- 10 95. 5-Bromo-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylsulphonylpyrazole.
96. 5-Acetamido-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylsulphonylpyrazole.
- 15 97. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-bis(ethoxycarbonyl)amino-4-trifluoromethanesulphonylpyrazole.
98. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-ethoxycarbonylamino-4-trifluoromethanesulphonylpyrazole.
- 20 99. 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-ethoxymethyleneamino-4-trifluoromethanesulphonylpyrazole.
100. 5-Amino-4-(2-chloro-1,1,2-trifluoroethylthio)-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-pyrazole.
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101. 3-Cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-5-dimethylamino-4-trifluoromethanesulphonyl-pyrazole.

The numbers 1 to 101 are assigned to the above
5 compounds for identification and reference hereinafter.

According to a feature of the present invention, there is provided a method for the control of arthropod, plant nematode, helminth or protozoan pests at a locus which comprises the treatment of the locus
5 (e.g. by application or administration) with an effective amount of a compound of general formula (I), wherein the various symbols are as hereinbefore defined. The compounds of general formula (I) may, in particular, be used in the field of veterinary medicine
10 and livestock husbandry and in the maintenance of public health against arthropods, helminths or protozoa which are parasitic internally or externally upon vertebrates, particularly warm-blooded vertebrates, for example man and domestic animals, e.g. cattle, sheep,
15 goats, equines, swine, poultry, dogs, cats and fishes, for example Acarina, including ticks (e.g. Ixodes spp., Boophilus spp. e.g. Boophilus microplus, Amblyomma spp., Hyalomma spp., Rhipicephalus spp. e.g. Rhipicephalus appendiculatus, Haemaphysalis spp.,
20 Dermacentor spp., Ornithodoros spp. (e.g. Ornithodoros moubata and mites (e.g. Damalinia spp., Dermahyssus gallinae, Sarcoptes spp. e.g. Sarcoptes scabiei, Psoroptes spp., Chorioptes spp., Demodex spp., Eutrombicula spp.,); Diptera (e.g. Aedes spp.,
25 Anopheles spp., Musca spp., Hypoderma spp., Gasterophilus spp., Simulium spp.); Hemiptera (e.g.

Triatoma spp.); Phthiraptera (e.g. Damalinia spp.,
Linognathus spp.); Siphonaptera (e.g. Ctenocephalides
spp.); Dictyoptera (e.g. Periplaneta spp., Blatella
spp.); Hymenoptera (e.g. Monomorium pharaonis); for
5 example against infections of the gastro-intestinal
tract caused by parasitic nematode worms, for example
members of the family Trichostrongylidae,
Nippostrongylus brasiliensis, Trichinella spiralis,
Haemonchus contortus, Trichostrongylus colubriformis,
10 Nematodirus battus, Ostertagia circumcincta,
Trichostrongylus axei, Cooperia spp. and Hymenolepis
nana; in the control and treatment of protozoal
diseases caused by, for example, Eimeria spp. e.g.
Eimeria tenella, Eimeria acervulina, Eimeria brunetti,
15 Eimeria maxima and Eimeria necatrix, Trypanosoma cruzi,
Leishmania spp., Plasmodium spp., Babesia spp.,
Trichomonadidae spp., Histomonas spp., Giardia spp.,
Toxoplasma spp., Entamoeba histolytica and Theileria
spp.; in the protection of stored products, for example
20 cereals, including grain and flour, groundnuts, animal
feedstuffs, timber and household goods, e.g. carpets
and textiles, against attack by arthropods, more
especially beetles, including weevils, moths and mites,
for example Ephestia spp. (flour moths), Anthrenus spp.
25 (carpet beetles), Tribolium spp. (flour beetles),
Sitophilus spp. (grain weevils) and Acarus spp.

(mites), in the control of cockroaches, ants and termites and similar arthropod pests in infested domestic and industrial premises and in the control of mosquito larvae in waterways, wells, reservoirs or other running or standing water; for the treatment of foundations, structure and soil in the prevention of the attack on buildings by termites, for example, Reticulitermes spp., Heterotermes spp., Coptotermes spp.; in agriculture, against adults, larvae and eggs of Lepidoptera (butterflies and moths), e.g. Heliothis spp. such as Heliothis virescens (tobacco budworm), Heliothis armigera and Heliothis zea, Spodoptera spp. such as S.exempta, S.littoralis (Egyptian cotton worm), S.eridania (southern army worm), Mamestra configurata (bertha army worm); Earias spp. e.g. E.insulana (Egyptian bollworm), Pectinophora spp. e.g. Pectinophora gossypiella (pink bollworm), Ostrinia spp. such as O.nubilalis (European cornborer), Trichoplusia ni (cabbage looper), Pieris spp. (cabbage worms), Laphygma spp. (army worms), Agrotis and Amathes spp. (cutworms), Wiseana spp. (porina moth), Chilo spp. (rice stem borer), Tryporyza spp. and Diatraea spp. (sugar cane borers and rice borers), Sparganothis pilleriana (grape berry moth), Cydia pomonella (codling moth), Archips spp. (fruit tree tortrix moths), Plutella xylostella (diamond back moth); against adult

and larvae of Coleoptera (beetles) e.g. Hypothenemus hampei (coffee berry borer), Hylesinus spp. (bark beetles), Anthonomus grandis (cotton boll weevil), Acalymma spp. (cucumber beetles), Lema spp., Psylliodes spp., Leptinotarsa decemlineata (Colorado potato beetle), Diabrotica spp. (corn rootworms), Gonocephalum spp. (false wire worms), Agriotes spp. (wireworms), Dermolepida and Heteronychus spp. (white grubs), Phaedon cochleariae (mustard beetle), Lissorhoptrus oryzophilus (rice water weevil), Meligethes spp. (pollen beetles), Ceutorhynchus spp., Rhynchophorus and Cosmopolites spp. (root weevils); against Hemiptera e.g. Psylla spp., Bemisia spp., Trialeurodes spp., Aphis spp., Myzus spp., Megoura viciae, Phylloxera spp., Adelges spp., Phorodon humuli (hop damson aphid), Aeneolamia spp., Nephotettix spp. (rice leaf hoppers), Empoasca spp., Nilaparvata spp., Perkinsiella spp., Pyrilla spp., Aonidiella spp. (red scales), Coccus spp., Pseudococcus spp., Helopeltis spp. (mosquito bugs), Lygus spp., Dysdercus spp., Oxycarenus spp., Nezara spp.; Hymenoptera e.g. Athalia spp. and Cephus spp. (saw flies), Atta spp. (leaf cutting ants); Diptera e.g. Hylemyia spp. (root flies), Atherigona spp. and Chlorops spp. (shoot flies), Phytomyza spp. (leaf miners), Ceratitis spp. (fruit flies); Thysanoptera such as Thrips tabaci; Orthoptera such as Locusta and

Schistocerca spp. (locusts) and crickets e.g. Gryllus spp. and Acheta spp.; Collembola e.g. Sminthurus spp. and Onychiurus spp. (springtails), Isoptera e.g. Odontotermes spp. (termites), Dermaptera e.g. Forficula spp. (earwigs) and also other arthropods of agricultural significance such as Acari (mites) e.g. Tetranychus spp., Panonychus spp. and Bryobia spp. (spider mites), Eriophyes spp. (gall mites), Polyphagotarsonemus spp.; Blaniulus spp. (millipedes), Scutigera spp. (symphylids), Oniscus spp. (woodlice) and Triops spp. (crustacea); nematodes which attack plants and trees of importance to agriculture, forestry and horticulture either directly or by spreading bacterial, viral, mycoplasma or fungal diseases of the plants, root-knot nematodes such as Meloidogyne spp. (e.g. M. incognita); cyst nematodes such as Globodera spp. (e.g. G. rostochiensis); Heterodera spp. (e.g. H. avenae); Radopholus spp. (e.g. R. similis); lesion nematodes such as Pratylenchus spp. (e.g. P. pratensis); Belonolaimus spp. (e.g. B. gracilis); Tylenchulus spp. (e.g. T. semipenetrans); Rotylenchulus spp. (e.g. R. reniformis); Rotylenchus spp. (e.g. R. robustus); Helicotylenchus spp. (e.g. H. multicinctus); Hemicycliophora spp. (e.g. H. gracilis); Criconeoides spp. (e.g. C. similis); Trichodorus spp. (e.g. T. primitivus); dagger nematodes such as Xiphinema spp.

(e.g. X. diversicaudatum), Longidorus spp. (e.g. L. elongatus); Hoplolaimus spp. (e.g. H. coronatus); Aphelenchoides spp. (e.g. A. ritzema-bosi, A. besseyi); stem and bulb eelworms such as Ditylenchus spp. (e.g. D. dipsaci).

5 The invention also provides a method for the control of arthropod or nematode pests of plants which comprises the application to the plants or to the medium in which they grow of an effective amount of a compound of general formula (I).

10 For the control of arthropods and nematodes, the active compound is generally applied to the locus in which arthropod or nematode infestation is to be controlled at a rate of about 0.1kg to about 25kg of active compound per hectare of locus treated. Under
15 ideal conditions, depending on the pest to be controlled, the lower rate may offer adequate protection. On the other hand, adverse weather conditions, resistance of the pest and other factors may require that the active ingredient be used in
20 higher proportions. In foliar application, a rate of 1g to 1000g/ha may be used.

 When the pest is soil-borne, the formulation containing the active compound is distributed evenly over the area to be treated in any convenient manner.
25 Application may be made, if desired, to the field or

crop-growing area generally or in close proximity to the seed or plant to be protected from attack. The active component can be washed into the soil by spraying with water over the area or can be left to the natural action of rainfall. During or after application, the formulation can, if desired, be distributed mechanically in the soil, for example by ploughing or disking. Application can be prior to planting, at planting, after planting but before sprouting has taken place or after sprouting.

The compounds of general formula (I) may be applied in solid or liquid compositions to the soil principally to control those nematodes dwelling therein but also to the foliage principally to control those nematodes attacking the aerial parts of the plants (e.g. Aphelenchoides spp. and Ditylenchus spp. listed above).

The compounds of general formula (I) are of value in controlling pests which feed on parts of the plant remote from the point of application, e.g. leaf feeding insects are killed by the subject compounds applied to roots.

In addition the compounds may reduce attacks on the plant by means of antifeeding or repellent effects.

The compounds of general formula (I) are of particular value in the protection of field, forage,

plantation, glasshouse, orchard and vineyard crops, of
ornamentals and of plantation and forest trees, for
example, cereals (such as maize, wheat, rice, sorghum),
cotton, tobacco, vegetables and salads (such as beans,
5 cole crops, curcurbits, lettuce, onions, tomatoes and
peppers), field crops (such as potato, sugar beet,
ground nuts, soyabean, oil seed rape), sugar cane,
grassland and forage (such as maize, sorghum, lucerne),
plantations (such as of tea, coffee, cocoa, banana, oil
10 palm, coconut, rubber, spices), orchards and groves
(such as of stone and pip fruit, citrus, kiwifruit,
avocado, mango, olives and walnuts), vineyards,
ornamental plants, flowers and shrubs under glass and
in gardens and parks, forest trees (both deciduous and
15 evergreen) in forests, plantations and nurseries.

They are also valuable in the protection of
timber (standing, felled, converted, stored or
structural) from attack by sawflies (e.g. Urocerus) or
beetles (e.g. scolytids, platypodids, lyctids,
20 bostrychids, cerambycids, anobiids), or termites, for
example, Reticulitermes spp., Heterotermes spp.,
Coptotermes spp.

They have applications in the protection of
stored products such as grains, fruits, nuts, spices
25 and tobacco, whether whole, milled or compounded into
products, from moth, beetle and mite attack. Also

protected are stored animal products such as skins,
hair, wool and feathers in natural or converted form
(e.g. as carpets or textiles) from moth and beetle
attack; also stored meat and fish from beetle, mite and
5 fly attack.

The compounds of general formula (I) are of
particular value in the control of arthropods,
helminths or protozoa which are injurious to, or spread
or act as vectors of diseases in man and domestic
10 animals, for example those hereinbefore mentioned, and
more especially in the control of ticks, mites, lice,
fleas, midges and biting, nuisance and myiasis flies.
The compounds of general formula (I) are particularly
useful in controlling arthropods, helminths or protozoa
15 which are present inside domestic host animals or which
feed in or on the skin or suck the blood of the animal,
for which purpose they may be administered orally,
parenterally, percutaneously or topically.

Coccidiosis, a disease caused by infections by
20 protozoan parasites of the genus Eimeria, is an
important potential cause of economic loss in domestic
animals and birds, particularly those raised or kept
under intensive conditions. For example, cattle,
sheep, pigs and rabbits may be affected, but the
25 disease is especially important in poultry, in
particular chickens.

The poultry disease is generally spread by the birds picking up the infectious organism in droppings on contaminated litter or ground or by way of food or drinking water. The disease is manifested by
5 hemorrhage, accumulation of blood in the ceca, passage of blood to the droppings, weakness and digestive disturbances. The disease often terminates in the death of the animal but the fowl which survive severe infections have had their market value substantially
10 reduced as a result of the infection.

Administration of a small amount of a compound of general formula (I) preferably by combination with poultry feed is effective in preventing or greatly reducing the incidence of coccidiosis. The compounds
15 are effective against both the cecal form (caused by E. tenella) and the intestinal forms (principally caused by E. acervulina, E. brunetti, E. maxima and E. necatrix).

The compounds of general formula (I) also exert
20 an inhibitory effect on the oocysts by greatly reducing the number and or the sporulation of those produced.

The compositions hereinafter described for topical application to man and animals and in the protection of stored products, household goods,
25 property and areas of the general environment may, in general, alternatively be employed for application to

growing crops and crop growing loci and as a seed dressing.

Suitable means of applying the compounds of general formula (I) include:-

- 5 to persons or animals infested by or exposed to infestation by arthropods, helminths or protozoa, by parenteral, oral or topical application of compositions in which the active ingredient exhibits an immediate and/or
- 10 prolonged action over a period of time against the arthropods, helminths or protozoa, for example by incorporation in feed or suitable orally-ingestible pharmaceutical formulations, edible baits, salt licks, dietary supplements,
- 15 pour-on formulations, sprays, baths, dips, showers, jets, dusts, greases, shampoos, creams, wax-smears and livestock self-treatment systems; to the environment in general or to specific locations where pests may lurk, including stored
- 20 products, timber, household goods, and domestic and industrial premises, as sprays, fogs, dusts, smokes, wax-smears, lacquers, granules and baits, and in tricklefeeds to waterways, wells, reservoirs and other running or standing water;
- 25 to domestic animals in feed to control fly larvae feeding in their faeces;

to growing crops as foliar sprays, dusts,
granules, fogs and foams; also as suspensions of
finely divided and encapsulated compounds of
general formula (I); as soil and root treatments
5 by liquid drenches, dusts, granules, smokes and
foams; and as seed dressings by liquid slurries
and dusts.

The compounds of general formula (I) may be
applied to control arthropods, helminths or protozoa in
10 compositions of any type known to the art suitable for
internal or external administration to vertebrates or
application for the control of arthropods in any
premises or indoor or outdoor area, containing as
active ingredient at least one compound of general
15 formula (I) in association with one or more compatible
diluent or adjuvants appropriate for the intended use.
All such compositions may be prepared in any manner
known to the art.

Compositions suitable for administration to
20 vertebrates or man include preparations suitable for
oral, parenteral, percutaneous, e.g. pour-on, or
topical administration.

Compositions for oral administration comprise
one or more of the compounds of general formula (I) in
25 association with pharmaceutically acceptable carriers
or coatings and include, for example, tablets, pills,

capsules, pastes, gels, drenches, medicated feeds, medicated drinking water, medicated dietary supplements, slow-release boluses or other slow-release devices intended to be retained within the gastro-intestinal tract. Any of these may incorporate
5 active ingredient contained within microcapsules or coated with acid-labile or alkali-labile or other pharmaceutically acceptable enteric coatings. Feed premixes and concentrates containing compounds of the present invention for use in preparation of medicated
10 diets, drinking water or other materials for consumption by animals may also be used.

Compositions for parenteral administration include solutions, emulsions or suspensions in any suitable pharmaceutically acceptable vehicle and solid
15 or semisolid subcutaneous implants or pellets designed to release active ingredient over a protracted period and may be prepared and made sterile in any appropriate manner known to the art.

Compositions for percutaneous and topical
20 administration include sprays, dusts, baths, dips, showers, jets, greases, shampoos, creams, wax-smears, or pour-on preparations and devices (e.g. ear tags) attached externally to animals in such a way as to provide local or systemic arthropod control.

Solid or liquid baits suitable for controlling arthropods comprise one or more compounds of general formula (I) and a carrier or diluent which may include a food substance or some other substance to induce
5 consumption by the arthropod.

Liquid compositions include water miscible concentrates, emulsifiable concentrates, flowable suspensions, wettable or soluble powders containing one or more compounds of general formula (I) which may be
10 used to treat substrates or sites infested or liable to infestation by arthropods including premises, outdoor or indoor storage or processing areas, containers or equipment and standing or running water.

Solid homogenous or heterogenous compositions
15 containing one or more compounds of general formula (I), for example granules, pellets, briquettes or capsules, may be used to treat standing or running water over a period of time. A similar effect may be achieved using trickle or intermittent feeds of water
20 dispersible concentrates as described herein.

Compositions in the form of aerosols and aqueous or non-aqueous solutions or dispersions suitable for spraying, fogging and low- or ultra-low volume spraying may also be used.

25 Suitable solid diluents which may be used in the preparation of compositions suitable for applying the

compounds of general formula (I) include aluminium silicate, kieselguhr, corn husks, tricalcium phosphate, powdered cork, absorbent carbon black, magnesium silicate, a clay such as kaolin, bentonite or
5 attapulgate, and water soluble polymers and such solid compositions may, if desired, contain one or more compatible wetting, dispersing, emulsifying or colouring agents which, when solid, may also serve as diluent.

10 Such solid compositions, which may take the form of dusts, granules or wettable powders, are generally prepared by impregnating the solid diluents with solutions of the compound of general formula (I) in volatile solvents, evaporating the solvents and, if
15 necessary, grinding the products so as to obtain powders and, if desired, granulating or compacting the products so as to obtain granules, pellets or briquettes or by encapsulating finely divided active ingredient in natural or synthetic polymers, e.g.
20 gelatin, synthetic resins and polyamides.

 The wetting, dispersing and emulsifying agents which may be present, particularly in wettable powders, may be of the ionic or non-ionic types, for example sulphoricinoleates, quaternary ammonium derivatives or
25 products based upon condensates of ethylene oxide with nonyl- and octyl-phenol, or carboxylic acid esters of

anhydrosorbitols which have been rendered soluble by etherification of the free hydroxy groups by condensation with ethylene oxide, or mixtures of these types of agents. Wettable powders may be treated with
5 water immediately before use to give suspensions ready for application.

Liquid compositions for the application of the compounds of general formula (I) may take the form of solutions, suspensions and emulsions of the compounds
10 of general formula (I) optionally encapsulated in natural or synthetic polymers, and may, if desired, incorporate wetting, dispersing or emulsifying agents. These emulsions, suspensions and solutions may be prepared using aqueous, organic or aqueous-organic
15 diluents, for example acetophenone, isophorone, toluene, xylene, mineral, animal or vegetable oils, and water soluble polymers (and mixtures of these diluents), which may contain wetting, dispersing or emulsifying agents of the ionic or non-ionic types or
20 mixtures thereof, for example those of the types described above. When desired, the emulsions containing the compounds of general formula (I) may be used in the form of self-emulsifying concentrates containing the active substance dissolved in the emulsifying agents or
25 in solvents containing emulsifying agents compatible with the active substance, the simple addition of water

to such concentrates producing compositions ready for use.

Compositions containing compounds of general formula (I) which may be applied to control arthropod, plant nematode, helminth or protozoan pests, may also contain synergists (e.g. piperonyl butoxide or sesamex), stabilizing substances, other insecticides, acaricides, plant nematocides, anthelmintics or anticoccidials, fungicides (agricultural or veterinary as appropriate e.g. benomyl, iprodione), bactericides, arthropod or vertebrate attractants or repellents or pheromones, reodorants, flavouring agents, dyes and auxiliary therapeutic agents, e.g. trace elements. These may be designed to improve potency, persistence, safety, uptake where desired, spectrum of pests controlled or to enable the composition to perform other useful functions in the same animal or area treated.

Examples of other pesticidally-active compounds which may be included in, or used in conjunction with, the compositions of the present invention are:- acephate, chlorpyrifos, demeton-S-methyl, disulfoton, ethoprofos, fenitrothion, malathion, monocrotophos, parathion, phosalone, pirimiphos-methyl, triazophos, cyfluthrin, cypermethrin, deltamethrin, fenpropathrin, fenvalerate, permethrin, aldicarb, carbosulfan,

methomyl, oxamyl, pirimicarb, bendiocarb,
teflubenzuron, dicofol, endosulfan, lindane,
benzoximate, cartap, cyhexatin, tetradifon,
avermectins, ivermectin, milbemycins, thiophanate,
5 trichlorfon, dichlorvos, diaveridine and dimetridazole.

The compositions for application to control
arthropod, plant nematode, helminth or protozoan pests
usually contain from 0.00001% to 95%, more particularly
from 0.0005% to 50%, by weight of one or more compounds
10 of general formula (I) or of total active ingredients
(that is to say the compound(s) of general formula (I)
together with other substances toxic to arthropods and
plant nematodes, anthelmintics, anticoccidials,
synergists, trace elements or stabilisers). The actual
15 compositions employed and their rate of application
will be selected to achieve the desired effect(s) by
the farmer, livestock producer, medical or veterinary
practitioner, pest control operator or other person
skilled in the art. Solid and liquid compositions for
20 application topically to animals, timber, stored
products or household goods usually contain from
0.00005% to 90%, more particularly from 0.001% to 10%,
by weight of one or more compounds of general formula
(I). For administration to animals orally or
25 parenterally, including percutaneously solid and liquid
compositions normally contain from 0.1% to 90% by

weight of one or more compound of general formula (I).
Medicated feedstuffs normally contain from 0.001% to 3%
by weight of one or more compounds of general formula
(I). Concentrates and supplements for mixing
with feedstuffs normally contain from 5% to 90%, and
5 preferably from 5% to 50%, by weight of one or more
compounds of general formula (I). Mineral salt licks
normally contain from 0.1% to 10% by weight of one or
more compounds of general formula (I).

Dusts and liquid compositions for application to
10 livestock, persons, goods, premises or outdoor areas
may contain 0.0001% to 15%, and more especially 0.005%
to 2.0%, by weight of one or more compounds of general
formula (I). Suitable concentrations in treated waters
are between 0.0001 ppm and 20 ppm, and more especially
15 0.001 ppm to 5.0 ppm. of one or more compounds of
general formula (I) and may also be used
therapeutically in fish farming with appropriate
exposure times. Edible baits may contain from 0.01% to
5% and preferably 0.01% to 1.0%, by weight of one or
20 more compounds of general formula (I).

When administered to vertebrates parenterally,
orally or by percutaneous or other means, the dosage of
compounds of general formula (I) will depend upon the
species, age and health of the vertebrate and upon the
25 nature and degree of its actual or potential

infestation by arthropod, helminth or protozoan pest.
A single dose of 0.1 to 100 mg, preferably 2.0 to 20.0 mg, per kg body weight of the animal or doses of 0.01 to 20.0 mg, preferably 0.1 to 5.0 mg, per kg body.

5 weight of the animal per day for sustained medication are generally suitable by oral or parenteral administration. By use of sustained release formulations or devices, the daily doses required over a period of months may be combined and administered to
10 animals on a single occasion.

In experiments on activity against arthropods carried out on representative compounds, the following results (wherein ppm indicates the concentration of the compound in parts per million of the test solution
15 applied) have been obtained:-

Test 1

One or more dilutions of the compounds to be tested were made in 50% aqueous acetone.

(a) Test species: Plutella xylostella (Diamond-back
20 Moth) and Phaedon cochleariae (Mustard Beetle).

Turnip leaf discs were set in agar in petri-dishes and infected with 10 larvae (2nd instar Plutella or 3rd instar Phaedon). Four replicate dishes were assigned to each treatment and were sprayed under
25 a Potter Tower with the appropriate test dilution. Four or five days after treatment the dishes were

removed from the constant temperature (25°C) room in which they had been held and the mean percentage mortalities of larvae were determined. These data were corrected against the mortalities in dishes treated with 50% aqueous acetone alone which served as controls.

(b) Megoura viciae (Vetch Aphid)

Potted tic bean plants previously infected with mixed stages of Megoura were sprayed to run-off using a laboratory turntable sprayer. Treated plants were held in a greenhouse for 2 days and were assessed for aphid mortality using a scoring system, judging the response in comparison with plants treated with 50% aqueous acetone alone, as controls. Each treatment was replicated 4 times.

Score	3	all aphids dead
	2	few aphids alive
	1	most aphids alive
	0	no significant mortality

(c) Test species: Spodoptera littoralis.

French bean leaf discs were set in agar in petri-dishes and infected with 5 larvae (2nd instar). Four replicate dishes were assigned to each treatment and were sprayed under a Potter Tower with the appropriate test dilution. After 2 days live larvae were transferred to similar dishes containing untreated leaves set in agar. Two or three days later the dishes

were removed from the constant temperature (25°C) room in which they had been held and the mean percentage mortalities of larvae were determined. These data were corrected against the mortalities in dishes treated with 50% aqueous acetone alone which served as controls.

According to the above method an application of the following compounds was effective against the larvae of Plutella xylostella producing at least 65% mortality at less than 500ppm:

1-10, 12-23, 25-27, 31-57, 59-70, 76-79, 81-88, 90-92, 96, 101.

According to the above method an application of the following compounds was effective against all stages of Megoura viciae producing a score of 7/12 at 50ppm:

11, 58, 71, 72, 73, 74, 75

According to the above method an application of the following compounds was effective against the larvae of Phaedon cochleariae producing at least 90% mortality at less than 5ppm:

24, 29, 80, 89

According to the above method an application of the following compounds was effective against the larvae of Spodoptera littoralis producing at least 70% mortality at less than 500ppm:

28, 30

The following Composition Examples illustrate compositions for use against arthropod, plant nematode, helminth or protozoan pests which comprise, as active ingredient, compounds of general formula (I). The
5 compositions described in Composition Examples 1 to 6 can each be diluted in water to give a sprayable composition at concentrations suitable for use in the field.

COMPOSITION EXAMPLE 1

10 A water soluble concentrate was prepared from
5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
henyl)-4-trifluoromethylthiopyrazole 7% w/v
Ethylan BCP 10% w/v
and N-methylpyrrolidone to 100% by volume
15 by dissolving the Ethylan BCP in a portion of
N-methylpyrrolidone, and then adding the active
ingredient with heating and stirring until dissolved.
The resulting solution was made up to volume by adding
the remainder of the solvent.

20 COMPOSITION EXAMPLE 2

An emulsifiable concentrate was prepared from
5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-trifluoromethylthiopyrazole 7% w/v
Soprophor BSU 4% w/v
25 Arylan CA 4% w/v
N-methylpyrrolidone 50% w/v

and Solvesso 150 to 100% by volume
by dissolving Soprophor BSU, Arylan CA and the active
ingredient in N-methylpyrrolidone, and then adding
Solvesso 150 to volume.

5 COMPOSITION EXAMPLE 3

A wettable powder was prepared from

5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-trifluoromethylthiopyrazole 40% w/w

Arylan S 2% w/w

10 Darvan No. 2 5% w/w

and Celite PF to 100% by weight

by mixing the ingredients, and grinding the mixture in
a hammer-mill to a particle size less than 50 microns.

COMPOSITION EXAMPLE 4

15 An aqueous flowable formulation was prepared from

5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-trifluoromethylthiopyrazole 30% w/v

Ethylan BCP 1% w/v

Sopropon T36 0.2% w/v

20 Ethylene glycol 5% w/v

Rhodigel 23 0.15% w/v

and Water to 100% by volume

by intimately mixing the ingredients and grinding in a
bead mill until the median particle size was less than

25 3 microns.

COMPOSITION EXAMPLE 5

An emulsifiable suspension concentrate was prepared from 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-trifluoromethylthiopyrazole 30% w/v

Ethylan BCP 10% w/v

5 Bentone 38 0.5% w/v

and Solvesso 150 to 100% by volume

by intimately mixing the ingredients and grinding in a bead mill until the median particle size was less than 3 microns.

10 COMPOSITION EXAMPLE 6

Water dispersible granules were prepared from

5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-trifluoromethylthiopyrazole 30% w/w

Darvan No. 2 15% w/w

15 Arylan S 8% w/w

and Celite PF to 100% by weight

by mixing the ingredients, micronising in a fluid-energy mill, and then granulating in a rotating pelletiser by spraying on sufficient water (up to 10% w/w). The resulting granules were dried in a fluid-bed drier to remove excess water.

Descriptions of commercial ingredients used in the foregoing Composition Examples:-

	Ethylan BCP	nonylphenol ethylene oxide condensate
	Soprophor BSU	condensate of tristyrylphenol and
5	ethylene oxide	
	Arylan CA	70% w/v solution of calcium
	dodecylbenzenesulphonate	
	Solvesso 150	light C ₁₀ -aromatic solvent
	Arylan S	sodium dodecylbenzenesulphonate
10	Darvan	sodium lignosulphonate
	Celite PF	synthetic magnesium silicate carrier
	Sopropon T36	sodium salt of polycarboxylic acid
	Rhodigel 23	polysaccharide xanthan gum
	Bentone 38	organic derivative of magnesium
15	montmorillonite	

COMPOSITION EXAMPLE 7

A dusting powder may be prepared by intimately mixing:-
5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-trifluoromethylthiopyrazole

20		1 to 10% w/w (weight/weight)
	Talc superfine	to 100% by weight

This powder may be applied to a locus of
arthropod infestation, for example refuse tips or
dumps, stored products or household goods or animals
25 infested by, or at risk of infestation by, arthropods
to control the arthropods by oral ingestion. Suitable

means for distributing the dusting powder to the locus of arthropod infestation include mechanical blowers, handshakers and livestock self treatment devices.

COMPOSITION EXAMPLE 8

5 An edible bait may be prepared by intimately mixing:-
5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-trifluoromethylthiopyrazole

0.1 to 1.0% w/w

Wheat flour

80% w/w

10

Molasses

to 100% w/w

This edible bait may be distributed at a locus, for example domestic and industrial premises, e.g. kitchens, hospitals or stores, or outdoor areas, infested by arthropods, for example ants, locusts, cockroaches and flies, to control the arthropods by oral ingestion.

15

COMPOSITION EXAMPLE 9

A solution may be prepared containing:-

20 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-trifluoromethylthiopyrazole

15% w/v (weight/volume)

Dimethylsulphoxide

to 100% by volume

by dissolving the pyrazole derivative in a portion of the dimethyl-sulphoxide and then adding more
25 dimethylsulphoxide to the desired volume. This solution may be applied to domestic animals infested by

arthropods, percutaneously as a pour-on application or, after sterilisation by filtration through a polytetrafluoroethylene membrane (0.22 micrometre pore size), by parenteral injection, at a rate of application of from 1.2 to 12 ml of solution per 100 kg of animal body weight.

COMPOSITION EXAMPLE 10

A wettable powder may be formed from:-

10	5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-trifluoromethylthiopyrazole	50% w/w
	Ethylan BCP (a nonylphenol/ethylene oxide condensate containing 9 moles of ethylene oxide per mol of phenol)	5% w/w
15	Aerosil (silicon dioxide of microfine-particle size)	5% w/w
	Celite PF (synthetic magnesium silicate carrier)	40% w/w

by adsorbing the Ethylan BCP onto the Aerosil, mixing with the other ingredients and grinding the mixture in a hammer-mill to give a wettable powder, which may be diluted with water to a concentration of from 0.001% to 2% w/v of the pyrazole compound and applied to a locus of infestation by arthropods, for example dipterous larvae, or plant nematodes by spraying, or to domestic animals infested by, or at risk of infestation by, arthropods, helminths or protozoa, by spraying or

dipping, or by oral administration in drinking water, to control the arthropods, helminths or protozoa.

COMPOSITION EXAMPLE 11

A slow release bolus may be formed from granules
5 containing a density agent, binder, slow-release agent
and 5-amino-3-cyano-1-(2,6-dichloro-4-
trifluoromethylphenyl)-4-trifluoromethylthiopyrazole
compound at varying percentage compositions. By
compressing the mixture a bolus with a specific gravity
10 of 2 or more can be formed and may be administered
orally to ruminant domestic animals for retention
within the reticulo-rumen to give a continual slow
release of pyrazole compound over an extended period of
time to control infestation of the ruminant domestic
15 animals by arthropods, helminths or protozoa.

COMPOSITION EXAMPLE 12

A slow release composition may be prepared from:-
5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-trifluoromethylthiopyrazole

20		0.5 to 25% w/w
	polyvinylchloride base	to 100% w/w

by blending the polyvinylchloride base with the
pyrazole compound and a suitable plasticiser, e.g.
dioctyl phthalate, and melt-extruding or hot-moulding
25 the homogenous composition into suitable shapes, e.g.
granules, pellets, brickettes or strips, suitable, for

example, for addition to standing water or, in the case of strips, fabrication into collars or ear-tags for attachment to domestic animals, to control insect pests by slow release of the pyrazole compound.

5. Similar compositions may be prepared by replacing the 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole in the Composition Examples by the appropriate quantity of any other compound of general formula (I).

10 The compounds of general formula (I) can be prepared by the application or adaptation of known methods (ie. methods heretofore used or described in the chemical literature), generally pyrazole ring formation followed where necessary by changing
15 substituents.

It is to be understood that in the description of the following processes that the sequences for the introduction of the various groups on the pyrazole ring may be performed in a different order and that suitable
20 protecting groups may be required as will be apparent to those skilled in the art: compounds of general formula (I) may be converted by known methods into other compounds of general formula (I).

In the following description when symbols
25 appearing in formulae are not specifically defined it is to be understood that they are "as hereinbefore

defined" in accordance with the first definition of each symbol in this specification. Within the process definitions, unless otherwise stated, amino refers to the unsubstituted amino group.

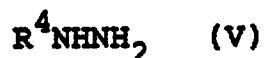
5 Compounds of general formula (I) wherein R^2
represents an R^5SO_2 , R^5SO or R^5S group, R^3 represents
the unsubstituted amino group and R^1 represents the
cyano or acetyl group may be prepared by a process
version "a" in which a compound of general formula (II)
10 wherein R^8 represents a cyano or acetyl group is
reacted with a compound of general formula R^2CH_2CN ,
preferably a molar equivalent thereof, generally in the
presence of an anhydrous inert organic solvent, e.g.
ethanol, and a molar equivalent of a base, e.g. sodium
15 ethoxide, and at a temperature from 0° to $50^\circ C$.

20. Compounds of general formula (I) wherein R^2 represents an R^5S group and R^3 represents an amino group $-NR^6R^7$ wherein R^6 and R^7 each represent a hydrogen atom or a straight or branched chain alkyl, alkenylalkyl or alkynylalkyl group as hereinbefore defined may be prepared by a process version "b" in which an intermediate corresponding to general formula (I) in which R^2 is replaced by the hydrogen atom is reacted with a compound of general formula:-



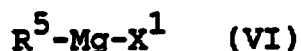
(wherein R^5 is as hereinbefore defined) in an inert organic solvent, preferably chloroform or dichloromethane, optionally in the presence of a base, preferably pyridine, and at temperatures from 0° to 50°C.

Compounds of general formula (I) wherein R^1 represents a chlorine or fluorine atom, R^2 represents an R^5SO_2 , R^5SO or R^5S group, and R^3 represents an amino group may be prepared by a process version "c" in which a compound of general formula (IV) wherein X and Y both represent chlorine atoms or both represent fluorine atoms, is reacted with a phenylhydrazine of general formula:-



(wherein R^4 is as hereinbefore defined) or an acid addition salt thereof, e.g. the hydrochloride, in an inert solvent, preferably ether or tetrahydrofuran, and optionally in the presence of a base, e.g. triethylamine or sodium acetate, and at a temperature from 0° to the reflux temperature of the solvent. When an acid addition salt of the compound of general formula (V) is used, the reaction with the compound of general formula (IV) is effected in the presence of an alkali metal, e.g. sodium or potassium, acetate, carbonate or bicarbonate.

According to a further process version "d" (1), compounds of general formula (I) wherein R^2 represents an R^5S group, R^1 represents a chlorine, bromine, iodine or fluorine atom or a cyano or nitro group, and R^3 represents an amino group may also be prepared by the reaction of corresponding 4-thiocyanatopyrazoles with an organometallic reagent such as a compound of general formula:-



wherein R^5 is as hereinbefore defined and X^1 represents a halogen atom in an inert solvent, such as diethyl ether or tetrahydrofuran, and at a temperature from $-78^\circ C$ to the reflux temperature of the reaction mixture or a compound of general formula:-



wherein $R^9-C\equiv C^-$ corresponds to R^5 in (I), in an inert solvent, such as tetrahydrofuran or diethyl ether, at temperatures from $-78^\circ C$ to ambient.

Alternatively, according to process version "d" (2), compounds of general formula (I) in which R^2 represents an R^5S group wherein R^5S is other than a 1-alkenylthio or 1-alkynylthio group may also be prepared by reacting an intermediate corresponding to general formula (I) in which R^2 is replaced by a thiocyanato group, with a base preferably sodium hydroxide, or a reducing agent preferably sodium

borohydride, in the presence of a reagent of general formula:-



wherein $R^{5'}$ is as hereinbefore defined for R^5 with the
5 exclusion of 1-alkenyl and 1-alkynyl and X^2 represents
a halogen, preferably bromine or iodine, for example
methyl iodide or propargyl bromide, or with a base
preferably sodium hydroxide, in the presence of a
reagent of general formula:-



wherein Z represents a fluorine, chlorine or bromine
atom and Z' is as hereinbefore defined for Z or
represents the trifluoromethyl group in an inert
organic or aqueous-organic solvent, such as methanol,
15 ethanol or dioxan or mixtures of these solvents with
water, the reaction being performed at a temperature
from -40°C to the reflux temperature.

Alternatively, according to process version "d"
(3), compounds of general formula (I) wherein R^5S is
20 other than a 1-alkenylthio or 1-alkynylthio group may
be prepared by reductive alkylation of disulphides of
general formula (VIII) employing a reducing agent
preferably sodium dithionite or sodium borohydride, in
the presence of a base, preferably sodium hydroxide or
25 sodium carbonate, and of a halide of general formula
(VII), such as methyl iodide, in an inert organic or
aqueous-organic solvent such as ethanol or a mixture of

alcohol and water, at a temperature from ambient to reflux.

According to a further process version "e", compounds of general formula (I) in which R^2 represents
5 an R^5SO or R^5SO_2 - group may be prepared by oxidation of the sulphur atoms of the corresponding alkylthio, alkenylthio or alkynylthio compounds of formula (I) wherein R^2 is a group R^5S as defined above; the oxidation may be effected employing oxidants of the
10 formula:-



wherein R^{10} represents the hydrogen atom, or a trifluoroacetyl or preferably 3-chlorobenzoyl group in a solvent e.g. dichloromethane or chloroform or
15 trifluoroacetic acid and at temperatures from $0^\circ C$ to $60^\circ C$, or with a reagent such as potassium hydrogen persulphate or potassium salt of Caro's acid in a solvent e.g. methanol and water, and at a temperature from $-30^\circ C$ to $50^\circ C$.

20 According to a further process version "f" (1), compounds of general formula (I) wherein R^1 represents a chlorine, bromine or iodine atom or a cyano or nitro group may be prepared by the diazotisation of an intermediate corresponding to general formula (I) in
25 which R^1 is replaced by the amino group and R^3 represents a hydrogen atom or the amino group using

sodium nitrite in a mineral acid, for example a mixture of concentrated sulphuric acid and acetic acid, at a temperature from 0° to 60°C, and by subsequent reaction with a copper salt and a mineral acid or with an aqueous solution of potassium iodide (when R¹ represents an iodine atom) at a temperature from 0° to 100°C; or with cuprous cyanide, or sodium nitrite in the presence of a copper salt in an inert solvent e.g. water at pH from 1 to 7 at 25° to 100°C. The diazotisation may alternatively be performed employing an alkyl nitrite e.g. tert-butyl nitrite in the presence of a suitable halogenating agent preferably bromoform or iodine or anhydrous cupric chloride at temperatures from 0°C to 100°C, and optionally in the presence of an inert solvent, preferably acetonitrile or chloroform.

According to a further process version "f" (2), compounds of general formula (I) wherein R¹ represents a fluorine atom and R³ represents a hydrogen atom or the amino group may be prepared by diazotisation of the corresponding amine wherein R¹ is replaced by the amino group using for example a solution of sodium nitrite in sulphuric acid and in the presence of fluoroboric acid or its sodium salt and subsequent thermolysis or photolysis of the diazonium fluoroborate derivative by methods known per se.

According to a further process version "g", compounds of general formula (I) wherein R^1 represents a fluorine atom or a cyano group, and R^3 represents a hydrogen atom or the amino group may be prepared by the reaction of a halide of general formula (I) wherein R^1 represents a chlorine or bromine atom with an alkali metal fluoride, preferably caesium fluoride, or with a metal cyanide preferably KCN under anhydrous conditions in an inert solvent, preferably sulpholane, and at a temperature from ambient to 150°C.

According to a further process version "h", compounds of general formula (I) wherein R^1 represents a nitro group, and R^2 is a group R^5SO_2 or R^5SO may be prepared by the reaction of an intermediate corresponding to general formula (I) in which R^1 is replaced by an unsubstituted amino group, and R^2 is a group R^5SO_2 , R^5SO or R^5S , and R^3 represents a hydrogen atom or the amino group with an oxidant, preferably trifluoroperacetic acid or m-chloroperbenzoic acid, in an inert solvent, preferably dichloromethane, at a temperature from 0°C to the reflux temperature. In this process concomitant oxidation at sulphur may occur when R^2 is R^5S .

According to a further process version "i", compounds of general formula (I) wherein R^1 represents the cyano group and R^3 represents a hydrogen atom or

the amino group may also be prepared by the dehydration of a compound corresponding to general formula (I) in which R^1 is replaced by the carbamoyl group. The compound corresponding to general formula (I) in which R^1 is replaced by the carbamoyl group may be prepared
5 by the reaction of a compound corresponding to general formula (I) in which R^1 is replaced by the carboxy group with a chlorinating agent, preferably thionyl chloride at ambient to reflux temperature, followed by reaction of the intermediate acid chloride with ammonia
10 to give an intermediate amide. The dehydration is generally effected by heating with a dehydrating agent e.g. phosphorus pentoxide or preferably phosphorus oxychloride at a temperature from 50°C to 250°C.

According to a further process version "j",
15 compounds of general formula (I) wherein R^1 is the acetyl group, and R^3 represents a hydrogen atom or the amino group may be prepared by the reaction of the corresponding nitrile of formula (I) wherein R^1 is the cyano group, or of esters wherein R^1 is replaced by an
20 alkoxycarbonyl group or of carboxylic acids wherein R^1 is replaced by a carboxy group with methyl lithium in an inert solvent, e.g. toluene, and at temperatures from -78°C to ambient. Alternatively the nitrile of formula (I) wherein R^1 is the cyano group or ester
25 wherein R^1 is replaced by an alkoxycarbonyl group may

be reacted with a Grignard reagent CH_3MgX^3 wherein X^3 represents a halogen, preferably iodine atom, in an inert solvent, e.g. diethyl ether or tetrahydrofuran, and at a temperature from 0°C to the reflux temperature of the solvent.

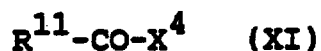
According to a further process version "k", compounds of general formula (I) wherein R^1 represents the acetyl group and R^3 is as defined above may alternatively be prepared by oxidation of alcohols corresponding to general formula (I) wherein R^1 is replaced by a 1-hydroxyethyl group, with an oxidant, preferably pyridinium chlorochromate, in an inert solvent, e.g. dichloromethane, and at a temperature from 0°C to the reflux temperature of the solvent.

According to a further process version "l", compounds of the general formula (I) wherein R^1 represents a formyl group and R^3 is as defined above may be prepared by the reaction of the corresponding nitriles of general formula (I) wherein R^1 represents a cyano group with

(1) a suitable reducing agent preferably diisobutylaluminium hydride in an inert solvent, preferably tetrahydrofuran and at a temperature from -78°C to the ambient temperature, followed by mild hydrolysis with an acid, e.g. dilute hydrochloric acid, at room temperature; or

(2) Raney nickel in formic acid preferably at the reflux temperature of formic acid.

Derivatives of the 5-amino group form a further feature of the present invention and are collectively referred to as process "m". Compounds of general formula (I) which conform to general formula (IA) wherein R^6 represents an $R^{11}C(=O)-$ group, wherein R^{11} represents a straight or branched-chain alkyl or alkoxy group containing from 1 to 4 carbon atoms, and R^7 represents a hydrogen atom or an $R^{11}C(=O)-$ group which is identical to the group $R^{11}C(=O)-$ represented by R^6 or $-NR^6R^7$ represents a cyclic imide as hereinbefore defined, may be prepared by the reaction of a compound of general formula (I) wherein R^3 represents the unsubstituted amino group, or an alkali metal salt thereof, with a compound of the general formula:-



wherein X^4 represents a chlorine or bromine atom, or with a compound of the general formula:-



or with a dicarboxylic acid derivative. The reaction may be conducted in the absence or presence of an inert organic solvent, for example acetonitrile, tetrahydrofuran, a ketone, e.g. acetone, an aromatic hydrocarbon, e.g. benzene or toluene, chloroform, dichloromethane or dimethylformamide, and optionally in

the presence of an acid-binding agent, for example pyridine, triethylamine or an alkali metal, e.g. sodium or potassium, carbonate or bicarbonate, at a temperature from 0°C to the reflux temperature of the reaction medium, to give a compound of general formula (IA) wherein R^6 represents an $R^{11}C(=O)-$ group wherein R^{11} is as hereinbefore defined and R^7 represents a hydrogen atom or an $R^{11}C(=O)-$ group, depending upon the reaction conditions chosen and/or the use of an excess of the compound of general formula (XI) or (XII), or $-NR^6R^7$ represents a cyclic imide as hereinbefore defined.

Compounds of general formula (IA) wherein R^6 represents a formyl group and R^7 represents a hydrogen atom or a formyl group, may be prepared by the reaction of a compound of general formula (I), wherein R^3 represents the unsubstituted amino group with formylacetic anhydride. Formylacetic anhydride may be prepared from formic acid and acetic anhydride and the reaction with the compound of general formula (I) may be conducted in the absence or presence of an inert organic solvent, for example a ketone, e.g. acetone, or an aromatic hydrocarbon, e.g. benzene or toluene, and optionally in the presence of an acid-binding agent, for example pyridine, triethylamine or an alkali metal, e.g. sodium or potassium, carbonate or bicarbonate, at

a temperature from 0°C to the reflux temperature of the reaction mixture, to give a compound of general formula (IA) wherein R^6 represents a formyl group and R^7 represents a hydrogen atom or a formyl group, depending upon the reaction conditions chosen and/or the use of an excess of formylacetic anhydride.

Compounds of general formula (IA) wherein R^6 represents a formyl group or a group $R^{11}C(=O)-$ and R^7 represents a hydrogen atom may be prepared by the selective removal by hydrolysis of an $R^{11}C(=O)-$ group or a formyl group from a compound of general formula (IA) wherein R^6 and R^7 both represent a $R^{11}C(=O)-$ group or a formyl group. Hydrolysis is effected under mild conditions, for example by treatment with an aqueous-ethanolic solution or suspension of an alkali metal, e.g. sodium or potassium, bicarbonate, or with aqueous ammonia.

Compounds of general formula (IA) wherein R^6 represents a straight or branched-chain alkoxycarbonyl group containing from 2 to 5 carbon atoms which is unsubstituted or substituted by one or more halogen atoms, and R^7 represents a hydrogen atom may be prepared by the reaction of a compound of the general formula (IB) wherein R^{12} represents an alkoxycarbonyl group $R^{13}C(=O)-$, wherein R^{13} represents a straight or branched-chain alkoxy group containing from 1 to 4

carbon atoms (which is unsubstituted or substituted by one or more halogen atoms) or a phenoxy group, with a compound of the general formula:-



5. (wherein R^{13} is as hereinbefore defined) to replace a first group represented by the symbol R^{12} by a hydrogen atom, and to replace the second group represented by the symbol R^{12} by an alkoxycarbonyl group when R^{12} represents a phenoxycarbonyl group, or, if desired, to
- 10 replace the second group represented by the symbol R^{12} by another alkoxycarbonyl group when R^{12} in formula (IB) represents an alkoxycarbonyl group. As will be apparent to those skilled in the art, the desired compound of general formula (IA) is obtained by
- 15 selection of the appropriate compounds of general formulae (IB) and (XIII). The reaction may be effected in water or an inert aqueous-organic or organic solvent, for example an alkanol containing 1 to 4 carbon atoms, e.g. ethanol, or an aromatic hydrocarbon,
- 20 e.g. benzene or toluene, or which is preferably an excess of the compound of general formula (XIII), at a temperature from ambient temperature to the reflux temperature of the reaction mixture and, if necessary, at elevated pressure, and optionally in the presence of
- 25 a base, for example an alkali metal alkoxide, e.g. of the compound of general formula (XIII).

Compounds of general formula (IA) wherein R^6 and R^7 , which may be the same or different, each represents a formyl group or $R^{11}C(=O)-$ group, may be prepared by the reaction of an alkali metal, e.g. sodium or potassium, derivative of a compound of general formula (IA) wherein R^6 represents a group $R^{11}C(=O)-$ as hereinbefore defined, or a formyl group, and R^7 represents a hydrogen atom with formylacetic anhydride or a compound of general formula (XI). Reaction may be effected in an inert aprotic solvent, e.g. dimethylformamide, at a temperature from laboratory temperature to the reflux temperature of the reaction mixture.

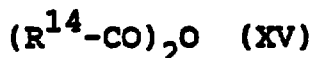
Alkali metal derivatives of compounds of general formula (I) (wherein R^3 represents the unsubstituted amino group) or (IA) wherein R^6 represents a group $R^{11}CO$ and R^7 represents a hydrogen atom may be prepared in situ by reaction with an alkali metal, e.g. sodium or potassium, hydride, in an inert aprotic solvent, e.g. dimethylformamide, at a temperature from laboratory temperature to the reflux temperature of the reaction mixture.

Compounds of general formula (IB) wherein R^{12} represents a group $R^{13}C(=O)-$, may be prepared as hereinbefore described. Intermediates of general formula (IB) wherein R^{12} represents a phenoxycarbonyl

group may be prepared by the reaction of a compound of general formula (I). (wherein R^3 represents the unsubstituted amino group), with a compound of general formula:-



(wherein R^{14} represents a phenoxy group and X^4 is as hereinbefore defined, e.g. phenyl chloroformate, or with a compound of general formula:-



10 (wherein R^{14} is as hereinbefore defined) using the reaction conditions hereinbefore described for the reaction of a compound of general formula (I) with a compound of formula (XI) or (XII).

Compounds of general formula (IA) wherein R^6 represents a group R^{15} which represents a straight or branched-chain alkyl, alkenylalkyl or alkynylalkyl group containing up to 5 carbon atoms and R^7 represents a hydrogen atom may be prepared by the removal of the group $R^{11}C(=O)-$ of a compound of the general formula (IA), wherein R^6 represents a group R^{15} and R^7 represents a group $R^{11}C(=O)-$. Removal of the group $R^{11}C(=O)-$ may be effected by selective hydrolysis under mild conditions, for example by treatment with an alkali metal, e.g. sodium or potassium, hydroxide in water or an inert organic or aqueous- organic solvent, for example a lower alkanol, e.g. methanol, or a

15
20
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mixture of water and lower alkanol, at a temperature from laboratory temperature up to the reflux temperature of the reaction mixture.

Compounds of general formula (IA), wherein R^6 represents a group R^{15} and R^7 represents a group $R^{11}C(=O)-$, may be prepared:

(1) by reaction of a compound of general formula (IA) wherein R^6 represents a hydrogen atom and R^7 represents a group $R^{11}C(=O)-$, or an alkali metal, e.g. sodium or potassium, derivative thereof, with a compound of the general formula:-



wherein X^5 represents a chlorine, bromine or iodine atom; the reaction may be effected in an inert organic solvent, e.g. dichloromethane, tetrahydrofuran, or dimethylformamide, at a temperature from laboratory temperature up to the reflux temperature of the reaction mixture and, when a compound of general formula (IA) is used, in the presence of a base, e.g. Triton B; or

(2) by reaction of a compound of general formula (IA) wherein R^6 represents the hydrogen atom and R^7 represents a group R^{15} with a compound of general formula (XI) or (XII).

Compounds of general formula (I) wherein R^3 represents an N-(alkyl, alkenylalkyl or alkynylalkyl)-

N-formylamino group as hereinbefore described may be prepared in a similar manner to the process just described, where appropriate, formylacetic anhydride instead of a compound of general formula (XI) or (XII).

5 Compounds of general formula (IA) wherein one or both of R^6 and R^7 represents a straight or branched-chain alkyl, alkenylalkyl or alkynylalkyl group containing up to 5 carbon atoms, groups represented by R^6 and R^7 being identical, may be
10 prepared by reaction of a compound of general formula (I), wherein R^3 represents the unsubstituted amino group, or an alkali metal, e.g. sodium or potassium, derivative thereof, with a compound of general formula (XVI), in the absence or presence of an inert organic
15 solvent, for example an aromatic hydrocarbon, e.g. benzene or toluene, chloroform, dichloromethane, tetrahydrofuran or dimethylformamide, and optionally in the presence of an acid-binding agent, for example pyridine, triethylamine or an alkali metal, e.g. sodium
20 or potassium, bicarbonate, at a temperature from 0°C up to the reflux temperature of the reaction mixture.

 According to a further process version "n", compounds of general formula (I) wherein R^3 represents a straight or branched-chain alkoxymethyleneamino group
25 containing from 2 to 5 carbon atoms which may be unsubstituted or substituted on methylene by a straight

or branched-chain alkyl group containing from 1 to 4 carbon atoms may be prepared by the reaction of a compound of general formula (I) (wherein R^3 represents the unsubstituted amino group) with a trisalkoxyalkane in the presence of an acidic catalyst, e.g. p-toluenesulphonic acid, at a temperature from ambient temperature to the reflux temperature of the reaction mixture.

According to a further process version "o", compounds of general formula (I) wherein R^3 represents a group $-NHCH_2R^{16}$ wherein R^{16} represents the hydrogen atom or a straight or branched-chain alkyl group containing from 1 to 4 carbon atoms may be prepared by reaction of a compound of general formula (I) wherein R^3 represents $-N=C(OR^{17})R^{16}$ wherein R^{17} represents a straight or branched-chain alkyl group containing from 1 to 4 carbon atoms with a reducing agent, preferably sodium borohydride. The reaction may be effected in an inert organic solvent, ethanol or methanol being preferred, at a temperature from 0°C to the reflux temperature of the reaction mixture.

Compounds of general formula (I), wherein R^3 represents a halogen atom, may be prepared by diazotisation of the corresponding compound of general formula (I) wherein R^3 represents the amino group, adopting the procedure of process "f" used above to

prepare compounds of general formula (I) wherein R^1 represents a halogen atom. Fluorides of general formula (I) wherein R^3 represents a fluorine atom may also be prepared by a halogen exchange reaction of
5 halides of general formula (I) wherein R^3 represents a chlorine or bromine atom, adopting the procedure of process "g" used above to prepare compounds (I) wherein R^1 represents a fluorine atom.

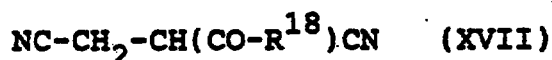
According to a further process version "p",
10 compounds of general formula (I) wherein R^1 represents the formyl, acetyl, cyano or nitro group, R^2 is as defined, and R^3 represents a fluorine atom may be prepared by a halogen exchange reaction with a compound of general formula (I) wherein R^3 represents a chlorine
15 or bromine atom by heating with an alkali metal fluoride preferably caesium fluoride in an inert solvent preferably sulpholane and at a temperature from 50°C to 150°C.

According to a further process version "q",
20 compounds of general formula (I) wherein R^3 represents a hydrogen atom may be prepared by treatment of a compound of general formula (I) wherein R^3 represents an amino group, with a diazotising agent preferably tertiary butyl nitrite in a solvent, preferably
25 tetrahydrofuran, and at ambient to the reflux temperature.

According to a further process version "r",
compounds of general formula (IA) wherein R^1 represents
a cyano or nitro group, R^2 is a group R^5SO_2 , R^6 and R^7
each represents a straight or branched chain alkyl,
5 alkenylalkyl or alkynylalkyl group containing up to 5
carbon atoms and R^7 may also represents a hydrogen atom
may be prepared by the reaction of a compound of
general formula (I) wherein R^3 represents a halogen,
preferably bromine, atom with the corresponding amine
10 within general formula R^6R^7NH , or dimethylhydrazine
when R^6 and R^7 are both methyl, in an inert solvent
preferably dioxan, tetrahydrofuran,
N,N-dimethylformamide, dimethylsulphoxide or sulpholane
and at a temperature from 25° to 100°C.

Intermediate compounds of the general formula (II) wherein the R^8 group represents a cyano or acetyl group may be prepared by diazotisation of the aniline R^4NH_2 (wherein R^4 is as hereinbefore defined) generally with a solution of a molar equivalent of sodium nitrite in a mineral acid, e.g. a mixture of concentrated sulphuric acid and acetic acid, at a temperature from 0° to $60^\circ C$, and then reacting with a compound of formula $CH_3COCH(Cl)CN$ [preparation described in J. Org. Chem 43 (20), 3822 (1978)] or a compound of general formula $CH_3COCH(Cl)COCH_3$ in the presence of an inert solvent, e.g. a mixture of water and ethanol, optionally buffered, e.g. with excess sodium acetate, and at a temperature from 0° to $50^\circ C$.

Intermediates corresponding to general formula (I) in which R^3 represents an amino group, R^2 is replaced by the hydrogen atom, and R^1 represents the cyano group may be prepared by diazotisation of the aniline R^4NH_2 (wherein R^4 is as hereinbefore defined) generally with a solution of a molar equivalent of sodium nitrite in a mineral acid, e.g. a mixture of concentrated sulphuric acid and acetic acid, at a temperature from 0° to $60^\circ C$, and then reacting with a compound of general formula:-



wherein R^{18} represents an alkoxy group containing from 1 to 6 carbon atoms, preferably the ethoxy group, or a hydrogen atom in the presence of an inert solvent, e.g. a mixture of water and ethanol, and optionally buffered, e.g. with sodium acetate, and at a temperature from 0 to 50°C. Subsequent mild hydrolysis with a base such as aqueous sodium hydroxide, sodium carbonate or ammonia may be necessary to effect the cyclisation.

Intermediates of general formula (XVII) used above, in which R^{18} represents the hydrogen atom, may be employed as alkali metal enolate salts which are converted into the aldehydes under the acidic conditions of the above coupling reaction.

Intermediates corresponding to general formula (I) in which R^1 is as defined with the exclusion of the formyl group, R^2 is replaced by the hydrogen atom and R^3 represents an amino group may be prepared by decarboxylation of a compound corresponding to general formula (I) wherein R^2 is replaced by the carboxy group, generally performed by heating at a temperature from 100°C to 250°C optionally in the presence of an inert organic solvent, particularly N,N-dimethylaniline. Alternatively intermediates corresponding to general formula (I) in which R^2 is replaced by a hydrogen atom, R^1 is as defined with the

exclusion of the formyl group, and R^3 represents an amino group may be prepared directly from esters corresponding to general formula (I) wherein R^2 represents a group $-COOR$ in which R represents a
5 straight or branched chain alkyl group containing from 1 to 6 carbon atoms, by heating in an inert organic solvent preferably acetic acid at a temperature from $50^\circ C$ to reflux, in the presence of a strong acid preferably hydrobromic acid. When the R^1 group within
10 the definition of this process is a chlorine or fluorine atom concomitant halogen exchange may also occur to give intermediates wherein R^2 and R^3 are as defined and R^1 represents a bromine atom.

Intermediate carboxy compounds corresponding to
15 general formula (I) in which R^1 is as defined with the exclusion of the formyl group, R^2 is replaced by the carboxy group and R^3 represents an amino group may be prepared by hydrolysis of esters wherein R^2 is replaced
20 by a group $-COOR$ as defined above, preferably with an alkali metal hydroxide in a solvent such as an aqueous alcohol at a temperature from $0^\circ C$ to the reflux temperature of the reaction mixture.

Intermediate esters corresponding to general formula (I) in which R^2 is replaced by a group $-COOR$ as
25 hereinbefore defined, R^3 is the amino group, and R^1 represents a cyano or acetyl group may be prepared in a

similar manner to process version "a", described hereinbefore, from esters ROOCCH_2CN and intermediates of general formula (II) wherein R^8 represents a cyano or acetyl group.

5 Intermediate esters corresponding to general formula (I) in which R^2 is replaced by a group $-\text{COOR}$ as hereinbefore defined, R^3 is the amino group and R^1 represents a chlorine or fluorine atom may be prepared by the reaction of a phenylhydrazine (V) with a
10 compound of general formula (XVIII) wherein X, Y and R are as hereinbefore defined, in a similar manner to the procedure of process version "c".

Alternatively intermediates corresponding to general formula (I) in which R^1 represents a chlorine
15 or fluorine atom, R^2 is replaced by a hydrogen atom, and R^3 represents the amino group, may be prepared by reaction of the corresponding aldehydes in which R^2 is replaced by the formyl group with an acid, preferably aqueous hydrochloric acid, in a solvent preferably
20 ethanol at a temperature from 50°C to the reflux temperature.

Intermediates corresponding to general formula (I) in which R^2 is replaced by a formyl group may be prepared by reaction of nitriles wherein R^2 is replaced
25 by a cyano group with a suitable reducing agent, preferably diisobutyl aluminium hydride in an inert

solvent, preferably tetrahydrofuran at a temperature from -78°C to ambient temperature.

Intermediates corresponding to general formula (I) in which R^2 is replaced by a cyano group may be prepared by the reaction of a compound of general formula (XIX) wherein X and Y are as hereinbefore defined (i.e. dichlorodicyanoethylene or difluorodicyanoethylene), with a phenylhydrazine (V) in a similar manner to process version "c".

Intermediates of general formula (XX) wherein R^{19} represents an R^2 group or a hydrogen atom and R^3 represents a hydrogen atom or an amino group may be prepared by performing a Curtius rearrangement of the acid azide corresponding to general formula (I) in which R^1 is replaced by CON_3 or in which R^2 is replaced by the hydrogen atom and R^1 is replaced by CON_3 by heating in an inert organic solvent such as toluene at a temperature from 50°C to 150°C to give an isocyanate which is then reacted with for example tert-butanol to give a carbamate, which in turn is hydrolysed using dilute acid preferably hydrochloric acid in ethanol at a temperature from ambient to reflux.

Intermediate acid azides may be prepared by reaction of a carboxylic acid corresponding to general formula (I) in which R^1 is replaced by a carboxy group and R^2 and R^3 are as defined above with an azide

transfer reagent such as diphenyl phosphoryl azide in the presence of a base, preferably triethylamine and in an inert solvent preferably N,N-dimethylformamide, and at a temperature from 0° to 60°C.

5 Intermediate carboxylic acids in which R^1 is replaced by a carboxylic acid group may be prepared by hydrolysis of the corresponding esters in which R^1 is replaced by an alkoxycarbonyl group e.g. ethoxycarbonyl, using a base such as sodium hydroxide
10 and a solvent such as aqueous alcohol, and at a temperature from 0°C to the reflux temperature of the solvent.

Intermediate carboxylic esters in which R^1 represents an alkoxycarbonyl group and wherein R^{19}
15 represents R^2 may be prepared by reaction of an intermediate (XXI) wherein R and R^2 are as hereinbefore defined and X^6 is a leaving group, e.g. the chlorine atom, with a phenylhydrazine (VI), in a similar manner to process version "c".

20 Intermediate carboxylic esters in which R^1 is replaced by an alkoxycarbonyl group as defined above, and R^2 is replaced by R^{19} , may alternatively be prepared in a similar manner to process version "a" by the reaction of a compound (II) wherein R^8 is replaced
25 by a -COOR group in which R is as hereinbefore defined, with a compound of general formula $R^{19}CH_2CN$ wherein R^{19} is as hereinbefore defined.

Intermediates corresponding to general formula (II) in which R^8 is replaced by $-COOR$ may be prepared from known compounds (e.g. $CH_3COCH(Cl)COOR$) in a similar manner to that described above for compounds of general formula (II) wherein R^8 represents a cyano or acetyl group.

Intermediate halides of general formula (XXI) wherein X^6 represents a chlorine atom and R and R^2 are as hereinbefore defined, may be prepared by the reaction of the sodium or potassium salts (XXI) wherein X^6 is $-O^-Na^+$ or $-O^-K^+$ with a suitable chlorinating agent, preferably phosphorus oxychloride, optionally in the presence of an inert solvent, e.g. tetrahydrofuran, and at a temperature from $0^\circ C$ to the reflux temperature of the solvent.

Intermediate salts (XXI) wherein X^6 is $-O^-Na^+$ or $-O^-K^+$ may be prepared by methods described in the literature, wherein active methylene compounds R^2CH_2CN are reacted with dialkyl oxalates, e.g. diethyl oxalate, in the presence of a metal alkoxide, e.g. sodium ethoxide, in an inert solvent, e.g. an alcohol such as ethanol, and at a temperature from $25^\circ C$ to the reflux temperature of the solvent.

Intermediates corresponding to general formula (I) in which R^1 is replaced by a 1-hydroxyethyl group

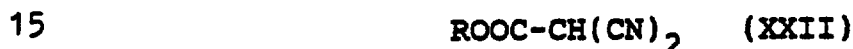
may be prepared by the reaction of aldehydes of general formula (I) wherein R^1 represents a formyl group and R^3 represents the hydrogen atom or an amino group with a Grignard reagent, preferably methyl magnesium halide, in an inert solvent, e.g. ether or tetrahydrofuran, and at a temperature from ambient to the reflux temperature of the solvent.

Intermediate 4-thiocyanatopyrazoles corresponding to general formula (I) in which R^2 is replaced by the thiocyanato group and R^3 represents the amino group may be prepared by the reaction of a compound corresponding to general formula (I) in which R^2 is replaced by the hydrogen atom with a thiocyanating agent, such as alkali metal or ammonium salts of thiocyanic acid (e.g. NaSCN) and bromine, in an inert organic solvent, such as methanol, and at a temperature from 0°C to 100°C.

Intermediate disulphides of general formula (VIII) may be prepared by the hydrolysis of thiocyanates in which R^2 is replaced by the thiocyanato group and R^1 represents a chlorine, bromine or fluorine atom or the cyano or nitro group using hydrochloric acid in the presence of ethanol or by reduction with sodium borohydride in ethanol, both being at a temperature from ambient to reflux. Alternatively the thiocyanates may be converted into compounds of general

formula (VIII) by treatment with base, preferably aqueous sodium hydroxide and preferably under phase-transfer conditions with chloroform as co-solvent and in the presence of a phase transfer catalyst e.g. triethyl- benzylammonium chloride and at a temperature from ambient to 60°C.

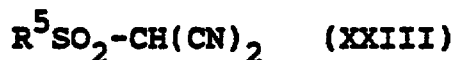
Intermediate diaminoesters corresponding to general formula (I) in which R^1 and R^3 represent the amino group and R^2 is replaced by an ester group -COOR as hereinbefore defined containing from 2 to 7 carbon atoms, may be prepared by reaction of an appropriately substituted phenylhydrazine of general formula (V) with an alkali metal salt of an alkyl dicyanoacetate of general formula:-



(wherein R is as hereinbefore defined) preferably potassium ethyl dicyanoacetate using hydrochloric acid, at ambient to reflux temperature. Alkyl dicyanoacetate potassium salts may be prepared by reaction of the appropriate alkyl chloroformate with malononitrile in the presence of potassium hydroxide in tetrahydrofuran at a temperature of 0 to 100°C.

Intermediate diaminosulphonylpyrazoles corresponding to general formula (I) in which R^1 and R^3 represent the amino group and R^2 represents a sulphonyl group R^5SO_2 may be prepared in a similar manner to the process just described by reaction of a phenylhydrazine

(V) with an alkali metal salt of a suitable alkylsulphonylmalononitrile of general formula:-



(wherein R^5 is as hereinbefore defined).

- 5 The preparation of compounds of general formula (XXIII) is described in the literature.

10 Intermediate esters corresponding to general formula (I) in which R^1 represents a chlorine, bromine or fluorine atom or a nitro group, R^2 is replaced by a group $-COOR$ as hereinbefore defined, and R^3 is an amino group, may be prepared in a similar manner to process version "f" via diazotisation of compounds corresponding to general formula (I) in which R^1 is replaced by an amino group.

- 15 Intermediate esters corresponding to general formula (I) in which R^1 is replaced by a group $-COOR$ as hereinbefore defined, R^2 is replaced by the hydrogen atom, and R^3 represents an amino group, may also be prepared from the reaction of a phenylhydrazine of
- 20 general formula (V) with an alkali metal salt of general formula (XXIV) wherein M is sodium or potassium and R is as hereinbefore defined. The reaction is performed in an acidic medium generally dilute sulphuric acid, optionally in the presence of a
- 25 co-solvent e.g. ethanol, and at a temperature from ambient to the reflux temperature of the solvent.

According to a further feature of the present invention there are provided intermediates of general formula (XXV), useful in the preparation of compounds of general formula (I), wherein $R^{2'}$ is as defined for R^2 or represents the hydrogen atom, a thiocyanato, formyl, cyano or carboxy group, a straight- or branched-chain alkoxy carbonyl group containing from 2 to 7 carbon atoms or the dithio group (which joins two pyrazole rings for example as in formula (VIII)), $R^{3'}$ is as defined for R^3 or represents the diphenoxycarbonylamino group, and $R^{1'}$ is as defined for R^1 or represents the amino, 1-hydroxyethyl, carboxy or carbamoyl group or a straight- or branched-chain alkoxy carbonyl or alkoxy carbonylamino group containing from 2 to 7 carbon atoms,

with the exclusion of compounds of general formula (I) and of those compounds of general formula (XXV) wherein R^4 represents 2,6-dichloro-4-trifluoromethylphenyl, $R^{2'}$ represents the cyano group, $R^{1'}$ represents the cyano group and $R^{3'}$ represents the amino, acetamido, dichloroacetamido, t-butylcarbonylamino, propionamido, pentanamido, bis(ethoxycarbonyl)amino, ethoxycarbonylamino, methylamino or ethylamino group,

or $R^{1'}$ represents the chlorine atom and $R^{3'}$ represents the amino, t-butylcarbonylamino, bis(ethoxycarbonyl)amino or ethoxycarbonylamino group,

or $R^{1'}$ represents a bromine or iodine atom or an amino or ethoxycarbonyl group and $R^{3'}$ represents the amino group,

5 or $R^{1'}$ represents the fluorine atom and $R^{3'}$ represents the hydrogen atom or the amino group,

or $R^{1'}$ represents a nitro, amino, t.butoxycarbonylamino or ethoxycarbonyl group and $R^{3'}$ represents the hydrogen atom;

10 R^4 represents a 2,4,6-trichlorophenyl, 2-chloro-4-trifluoromethylphenyl or 2,6-dichloro-4-trifluoromethoxyphenyl group, $R^{2'}$ represents the cyano group, $R^{1'}$ represents the cyano group and $R^{3'}$ represents the amino group;

15 R^4 represents a 2,6-dichloro-4-trifluoromethoxyphenyl group, $R^{2'}$ represents the cyano group, $R^{1'}$ represents the chlorine atom and $R^{3'}$ represents the amino group; and R^4 represents the 2,6-dichloro-4-trifluoromethylphenyl group, $R^{2'}$ represents the methanesulphonyl group, $R^{1'}$ represents a 20 carboxy, carbamoyl or ethoxycarbonyl group and $R^{3'}$ represents the amino group.

5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole is a preferred intermediate.

The following Examples and Reference Examples illustrate the preparation of compounds of general formula (I) according to the present invention:

5 [Chromatography was effected on a silica column (May & Baker Ltd 40/60 flash silica) at a pressure of 6.8Nm^{-2} , unless otherwise stated.]

EXAMPLE 1

Compounds Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 90.

- 10 A solution of 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole (20.0g) in dichloromethane (100ml) was stirred magnetically and treated dropwise with a solution of trifluoromethylsulphenyl chloride (10.8g) in
- 15 dichloromethane (50ml) during 1 hour. The solution was stirred overnight at room temperature, then washed with water (100ml), dried over anhydrous magnesium sulphate, filtered, and evaporated in vacuo to give a solid (26.3g). This solid was recrystallised from
- 20 toluene/hexane to give 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole as fawn crystals (24.2g) m.p. $169-171^{\circ}\text{C}$.
- 25 By proceeding in a similar manner but replacing the 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole by the hereinafter indicated

appropriately substituted pyrazole there was obtained from trifluoromethylsulphenyl chloride unless otherwise stated:

5 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethoxy-phenyl)-4-trifluoromethylthiopyrazole, m.p. 125-126°C, in the form of pale yellow crystals, from 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethoxy-phenyl)pyrazole.

10 5-Amino-3-cyano-1-(2,6-dichloro-4-difluoromethoxy-phenyl)-4-trifluoromethylthiopyrazole, m.p. 127-128.5°C, in the form of a buff solid, from 5-amino-3-cyano-1-(2,6-dichloro-4-difluoromethoxy-phenyl)pyrazole.

15 5-Amino-1-(2-chloro-4-trifluoromethylphenyl)-3-cyano-4-trifluoromethylthiopyrazole, m.p. 142-144°C, in the form of a light brown solid, from 5-amino-1-(2-chloro-4-trifluoromethylphenyl)-3-cyanopyrazole.

20 5-Amino-3-cyano-1-(2,4,6-trichlorophenyl)-4-trifluoromethylthiopyrazole, m.p. 192-193°C, in the form of brown crystals, from 5-amino-3-cyano-1-(2,4,6-trichlorophenyl)pyrazole.

25 5-Amino-3-cyano-1-(2,6-dibromo-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole, m.p. 202-204°C, in the form of orange crystals, from 5-amino-3-cyano-1-(2,6-dibromo-4-trifluoromethylphenyl)pyrazole.

- 5-Amino-1-(2-bromo-4-trifluoromethylphenyl)-3-cyano-4-trifluoromethylthiopyrazole, m.p. 136-138°C, in the form of a pale yellow solid, from 5-amino-1-(2-bromo-4-trifluoromethylphenyl)-3-cyanopyrazole.
- 5 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-difluoromethylthiopyrazole, m.p. 159-161°C, in the form of a light brown solid, from 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole and difluoromethylsulphenyl chloride.
- 10 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-heptafluoropropylthiopyrazole, m.p. 148-150°C, in the form of a yellow solid, after dry column flash chromatography on silica eluting with dichloromethane and petroleum ether (2:1); from
- 15 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl) pyrazole and heptafluoropropylsulphenyl chloride.
- 20 5-Amino-1-(2-bromo-6-chloro-4-trifluoromethylphenyl)-3-cyano-4-trifluoromethylthiopyrazole, m.p. 183-185°C, in the form of yellow crystals, from 5-amino-1-(2-bromo-6-chloro-4-trifluoromethylphenyl)-3-cyanopyrazole and employing tetrahydrofuran as solvent.
- 25 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trichloromethylthiopyrazole, m.p. 245-247°C,

in the form of a white solid after purification by chromatography, starting from 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole and trichloromethylsulphenyl chloride.

5 By proceeding in a similar manner but replacing the trifluoromethylsulphenyl chloride by dichlorofluoromethylsulphenyl chloride, and by the addition of a molar equivalent of pyridine to the reaction mixture after stirring overnight there was
10 obtained:

5-Amino-3-cyano-4-dichlorofluoromethylthio-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole, m.p. 178-180°C in the form of a white solid, after purification by chromatography eluting with diethyl
15 ether/hexane (1:1); from 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole.

By proceeding in a similar manner but employing a molar equivalent of pyridine in the reaction solution there was obtained:

20 5-Amino-3-chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole, m.p. 149-150.5°C, in the form of a white solid, after recrystallisation from hexane from 5-amino-3-chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole.

25 5-Amino-3-bromo-1-(2,6-dichloro-4-trifluoromethyl-

phenyl)-4-trifluoromethylthiopyrazole, m.p.

154.5-156°C, in the form of a white solid, after recrystallisation from hexane/ethyl acetate and then from hexane/cyclohexane, starting from

5 5-amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole.

5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-fluoro-4-trifluoromethylthiopyrazole, m.p. 123-126°C, in the form of a white solid, starting from

10 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-fluoropyrazole.

5-Amino-4-chlorodifluoromethylthio-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole, m.p. 167-168°C, in the form of a white solid, starting from
15 chlorodifluoromethylsulphenyl chloride. The product was purified by high performance liquid chromatography employing a 8 micron irregular column (21.4mm x 25cm) and eluting with acetonitrile/water (3:2).

Reference Example 1.

20 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole used in the above Example was prepared as follows:

A suspension of nitrosyl sulphuric acid prepared from sodium nitrite (7.0g) and concentrated sulphuric acid
25 (27.5ml) was diluted with acetic acid (25ml), cooled to

25°C, and stirred mechanically. To this was added a solution of 2,6-dichloro-4-trifluoromethylaniline (21.2g) in acetic acid (50ml) dropwise over 15 minutes at 25-32°C. This mixture was heated to 55°C for 20 minutes and poured onto a stirred solution of ethyl 2,3-dicyanopropionate (14.0g) in acetic acid (60ml) and water (125ml) at 10-20°C. After 15 minutes, water (200ml) was added, and the oily layer separated. The aqueous solution was then extracted with dichloromethane (3 x 70ml) and the extracts combined with the oil and washed with ammonia solution (to pH9). The organic phase was then stirred with ammonia (20ml) for 2 hours, and the dichloromethane layer then separated. This was washed with water (1 x 100ml), 1N hydrochloric acid (1 x 100ml), dried over anhydrous magnesium sulphate, filtered, and evaporated in vacuo to give an oily solid. Crystallisation from toluene/hexane gave the title compound as brown crystals (20.9g), m.p. 140-142°C.

By proceeding in a similar manner but replacing the 2,6-dichloro-4-trifluoromethylaniline by the appropriately substituted anilines there was obtained: 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethoxy-phenyl)pyrazole in the form of a fawn solid, m.p.

119-120.5°C, from 2,6-dichloro-4-trifluoromethoxy-aniline.

5 5-Amino-3-cyano-1-(2,6-dichloro-4-difluoromethoxy-phenyl)pyrazole, after washing the initially formed product as a solution in dichloromethane with saturated sodium carbonate solution. The title compound was obtained as a yellow solid after recrystallisation from toluene, m.p. 120.5-122.5°C, from
10 2,6-dichloro-4-difluoromethoxy-aniline.

5-Amino-1-(2-chloro-4-trifluoromethylphenyl)-3-cyanopyrazole in the form of an orange crystalline solid, m.p. 133-135°C, from 2-chloro-4-trifluoromethylaniline.

15 5-Amino-3-cyano-1-(2,4,6-trichlorophenyl)pyrazole in the form of a light brown solid, m.p. 155-156°C, from 2,4,6-trichloroaniline.

5-Amino-3-cyano-1-(2,6-dibromo-4-trifluoromethylphenyl)pyrazole in the form of a yellow crystalline solid, m.p. 142-146°C, from 2,6-dibromo-4-trifluoromethylaniline.
20

5-Amino-1-(2-bromo-6-chloro-4-trifluoromethylphenyl)-3-cyanopyrazole in the form of a brown crystalline solid, m.p. 146-148°C, from 2-bromo-6-chloro-4-trifluoromethylaniline.

25

5-Amino-1-(2-bromo-4-trifluoromethylphenyl)-3-cyano-pyrazole in the form of a yellow crystalline solid, m.p. 159-162°C, from 2-bromo-4-trifluoromethylaniline.

5-Amino-3-chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole, used in Example 1, was prepared as follows:

A mixture of 5-amino-3-chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-ethoxycarbonylpyrazole (5.0g) and hydrochloric acid (6N; 75ml) in glacial acetic acid (75ml) was heated at reflux for 24 hours. The cooled reaction mixture was evaporated to low bulk and basified to pH 12 with sodium hydroxide (2N) and extracted with diethyl ether (3 x 75ml). The ether extracts were combined and evaporated in vacuo to give a mixture of 5-amino and 5-acetamido pyrazoles in the form of a yellow gummy solid (3.5g). This solid was dissolved in a mixture of hydrochloric acid (6N; 30ml) and dioxan (60ml) and heated at reflux for 48 hours. The volatiles were removed in vacuo and the residue purified by column chromatography using dichloromethane-hexane (4:1). Evaporation of the eluate containing the major component gave the title compound (1.3g), m.p. 128-129°C, in the form of an off-white solid.

5-Amino-3-chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-ethoxycarbonylpyrazole, used above, was prepared as follows:

5 Tertiary-butyl nitrite (15.0g) was added dropwise to a stirred and cooled (0°C) mixture of
3,5-diamino-1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-ethoxycarbonylpyrazole (50.0g) and cupric chloride
(21.0g) in acetonitrile (600ml) over 10 minutes. The
10 reaction mixture was stirred for 2 hours at 0°C and 2
hours at laboratory temperature then evaporated to low
bulk and poured into hydrochloric acid (5N; 1500ml).
The resultant solution was extracted with
dichloromethane (3 x 600ml), washed with hydrochloric
acid (2N; 2 x 600ml), dried over anhydrous magnesium
15 sulphate and evaporated to furnish a brown tar. The
tarry material was removed from the product using a dry
silica chromatography eluted with
dichloromethane-hexane (4:1), further purification by
column chromatography using hexane containing
20 increasing proportions of dichloromethane (60 to 80%)
gave the title compound (15.8g), m.p. 143-146.5°C, in
the form of an orange solid.
3,5-Diamino-1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-ethoxycarbonylpyrazole, used above, was prepared as
25 follows:

Ethyl dicyanoacetate potassium salt (35.2g) was added to a stirred suspension of 2,6-dichloro-4-trifluoromethylphenylhydrazine (49g) in hydrochloric acid (0.9N; 220ml) and the reaction mixture stirred and heated at reflux for 18 hours. The reaction mixture was then cooled to precipitate a solid which was filtered off, triturated with diethyl ether (250ml) and dried to give an off-white solid (56g) which was recrystallised from a mixture of ethyl acetate and hexane to give the title compound (29.2g), m.p. 196-197°C, in the form of an off-white solid.

Ethyl dicyanoacetate potassium salt was prepared as follows:

A solution of ethyl chloroformate (520g) and malononitrile (330g) in tetrahydrofuran (500ml) was added dropwise over one hour to a stirred solution of potassium hydroxide (560g) and water (2.0l) at a temperature below 40°C (external ice cooling). The reaction mixture was stirred at laboratory temperature for 1 hour then cooled to 0°C to precipitate a solid which was filtered off and dried over phosphorus pentoxide to give the title compound, (334.4g) in the form of an off-white solid.

5-Amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole, used in the above Example, was prepared as follows:

A mixture of 5-amino-4-carbethoxy-3-chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole (3.3g) and hydrobromic acid (48%, 30ml) in glacial acetic acid (50ml) was heated at reflux for 18 hours. The mixture
5 was evaporated to low bulk, basified with sodium hydroxide solution (1N) and the product filtered off and dried (2.9g). Recrystallisation from a mixture of ethanol and water gave the title compound (2.5g), m.p. 132.5-134°C, in the form of a colourless solid.

10 5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-fluoropyrazole, used in the above Example was prepared as follows:

A mixture of 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-fluoro-4-formylpyrazole (1.5g) in methanol
15 (40ml) and 2N hydrochloric acid (10ml) was heated under reflux for 24 hours. After evaporation in vacuo, water (100ml) was added, and the mixture extracted with ethyl acetate (2 x 100ml). The extract was washed with saturated sodium bicarbonate solution (50ml), dried
20 over anhydrous magnesium sulphate, and evaporated in vacuo.

Purification by chromatography eluting with dichloromethane gave the title compound, m.p. 128-129°C, in the form of a white solid.

25 5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-

3-fluoro-4-formylpyrazole, used above, was prepared as follows:

A stirred solution of 5-amino-4-cyano-(2,6-dichloro-4-trifluoromethylphenyl)-3-fluoropyrazole (preparation described in PCT Patent Publication WO 8703-781-A) (2.2g) in dry tetrahydrofuran (40ml) was treated at -70°C under nitrogen with a solution of diisobutylaluminium hydride (13ml of a 1M toluene solution). The mixture was allowed to warm to room temperature over 2 hours, left overnight, and poured onto a mixture of 2N hydrochloric acid (50ml) and ice (50g). After stirring for $\frac{1}{2}$ hour, toluene (25ml) was added, and the organic layer separated. The aqueous layer was re-extracted with dichloromethane (2 x 100ml), and the combined organic solution washed with sodium bicarbonate solution (20ml) and dried over anhydrous magnesium sulphate. Evaporation in vacuo gave a brown solid (1.5g), which was purified by chromatography eluting with toluene/ethyl acetate (98:2) to give the title compound (1.0g), m.p. 137-139.5°C, in the form of a pale yellow solid.

EXAMPLE 2

Compounds Nos. 16, 17.

A mixture of anhydrous cupric chloride (1.15g) in acetonitrile (20ml) was stirred whilst tert-butyl

nitrite (0.73g) was added at 0°C. After 10 minutes, a solution of 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole (3.0g) in acetonitrile (5ml) was added at 0°C and the mixture stirred at 0°C for 2 hours, and then at room temperature overnight. After evaporation in vacuo the residue was dissolved in a mixture of dichloromethane (50ml) and hydrochloric acid (5M; 50ml). The organic layer was dried over anhydrous magnesium sulphate, evaporated in vacuo and then purified by chromatography, eluting with petroleum ether (b.p.60-80°C)/dichloromethane (2:1). Recrystallisation of the resultant product from petroleum ether (b.p.60-80°C) gave 5-chloro-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole (0.55g) as a white crystalline solid, m.p. 131-132°C. By proceeding in a similar manner but starting from 3,5-diamino-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole and performing the reaction at 0°C for 2 hours and then warming to reflux temperature there was obtained:
5-Amino-3-chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole, m.p. 177-179°C, in the form of a white solid, after purification by chromatography eluting with dichloromethane, and then recrystallising from toluene/hexane.

Reference Example 2

3,5-Diamino-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole, used in the above Example, was prepared as follows:

- 5 Potassium carbonate (11.7g) was added portionwise to a stirred mixture of methanesulphonylmalononitrile hydrochloride (30.0g) in water (150ml).
2,6-Dichloro-4-trifluoromethylphenylhydrazine (41.0g) was then added and the mixture heated at 100°C
10 overnight. After cooling the yellow solid was filtered, washed with water, and recrystallised from aqueous methanol. This solid was washed thoroughly with ether, yielding the title compound as a white solid (14.6g) m.p. 224-226°C.

15 EXAMPLE 3

Compounds Nos. 18, 19, 20, 99.

- 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole (4.0g) was added to triethyl orthoformate (19.0ml) and
20 p-toluene/sulphonic acid (0.019g) added.
The mixture was heated under reflux for 21 hours, cooled, and the triethyl orthoformate evaporated in vacuo to give a brown oil as residue. This was
25 purified by chromatography eluting with a mixture of dichloromethane and hexane (1:1). Evaporation of the

eluates in vacuo gave 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-ethoxymethyleneamino-4-trifluoromethylthiopyrazole as a colourless solid, m.p. 70-71.5°C.

- 5 By proceeding in a similar manner but replacing the triethyl orthoformate with triethyl orthoacetate and employing toluene as co-solvent there was obtained: 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-ethoxyethylideneamino-4-trifluoromethylthiopyrazole
10 as a pale yellow solid, m.p. 71-73°C.

- By proceeding in a similar manner but replacing the 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole by 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
15 4-methanesulphonylpyrazole, and by employing triethyl orthoformate and toluene, there was obtained: 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-ethoxymethyleneamino-4-methanesulphonylpyrazole, m.p. 145-147°C, in the form of a cream solid.

- 20 By proceeding in a similar manner there was prepared from 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylsulphonylpyrazole and triethyl orthoformate and in the absence of toluene as co-solvent:

3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
5-ethoxymethyleneamino-4-trifluoromethylsulphonyl-
pyrazole, m.p. 118.8-119.8°C, in the form of a white
solid, and after recrystallisation from hexane.

5 EXAMPLE 4

Compounds Nos. 21, 22, 23, 24, 96.

To a stirred solution of 5-amino-3-cyano-
1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-trifluoromethylthiopyrazole (4.0g) and acetyl
10 chloride (2.3g) in acetonitrile (40ml) at 0°C was added
pyridine (1.3ml) dropwise. The yellow solution was
warmed to room temperature during 45 minutes and then
heated under reflux for 24 hours. The cooled solution
was evaporated in vacuo and the residue dissolved in
15 dichloromethane (100ml), washed with water (2 x 100ml),
dried over anhydrous magnesium sulphate and evaporated
in vacuo to give a buff solid (4.2g). This was
purified by chromatography eluting with dichloromethane
to give 5-acetamido-3-cyano-1-(2,6-dichloro-
20 4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole
(2.0g) as a colourless solid, m.p. 217-218°C, after
recrystallisation from toluene.

By proceeding in a similar manner but replacing the
acetyl chloride by propionyl chloride there was
25 obtained the following two compounds:

- 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
5-bis(propionyl)amino-4-trifluoromethylthiopyrazole,
m.p. 128-130°C, in the form of a white crystalline
solid, and 3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-5-propionamido-4-trifluoromethylthiopyrazole,
5 m.p. 178.5-182°C, in the form of a pale yellow solid.
By proceeding in a similar manner, but replacing the
5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-trifluoromethylthiopyrazole by
10 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-methanesulphonylpyrazole, there was obtained:
5-Acetamido-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-methanesulphonylpyrazole, m.p. 220-222°C, in
the form of a cream solid.
15 By proceeding in a similar manner there was obtained
5-acetamido-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-trifluoromethylsulphonylpyrazole, m.p.
208-211°C, in the form of a white solid, from
5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
20 phenyl)-4-trifluoromethylsulphonylpyrazole. The
reaction mixture was heated at reflux for 3 hours in
this instance.

EXAMPLE 5

Compounds Nos. 25, 26, 27, 28, 29, 30, 97.

To a stirred solution of 5-amino-3-cyano-
1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-trifluoromethylthiopyrazole (5.0g) in dry
tetrahydrofuran (80ml) stirred under nitrogen at room
temperature, was added sodium hydride (0.36g of an 80%
oil dispersion) during $\frac{1}{2}$ hour. After a further $\frac{1}{2}$ hour,
2 drops of 15-crown-5 followed by trimethylacetyl
chloride (1.6g) was added, and the mixture heated under
reflux for 24 hours. After cooling to 0°C a further
addition of sodium hydride (0.15g) followed by
trimethylacetyl chloride (0.8g) was made, and the
mixture refluxed for another 18 hours. The mixture was
cooled, poured onto water (100ml) and extracted with
ether (2 x 80ml). The ether extracts were dried
over anhydrous magnesium sulphate, and evaporated in
vacuo to give a yellow oil (6.2g), which was purified
by chromatography eluting with petroleum
ether/dichloromethane (3:2) to give 3-cyano-
1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-trifluoromethylthio-5-trimethylacetamidopyrazole
(0.82g), m.p. 172.5-173.5°C, in the form of a white
solid.

By proceeding in a similar manner but replacing the trimethylacetyl chloride by the appropriate acylating agents there was prepared:

5 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
5-bis(methoxycarbonyl)amino-4-trifluoromethylthio-
pyrazole, m.p. 135-136.5°C, in the form of a white
solid, using methyl chloroformate.

10 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
5-bis(ethoxycarbonyl)amino-4-trifluoromethylthio-
pyrazole, m.p. 83.2-85.5°C, in the form of a white
solid, using ethyl chloroformate and performing the
reaction at ambient temperature.

15 5-Chloroacetamido-3-cyano-1-(2,6-dichloro-
4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole,
m.p. 175-176°C, in the form of a white solid, using
chloroacetyl chloride, and after purification by
chromatography and recrystallisation from
toluene/hexane.

20 By proceeding in a similar manner but replacing the
5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-trifluoromethylthiopyrazole by 5-amino-
3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-methanesulphonylpyrazole and by the use of
appropriate acylating agents, there was prepared:

25 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-

5-bis(ethoxycarbonyl)amino-4-methanesulphonylpyrazole in the form of a white solid, m.p. 195-198°C, using ethyl chloroformate.

5 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-methanesulphonyl-5-trimethylacetamidopyrazole in the form of a white solid, m.p. 245-247°C, using trimethylacetyl chloride.

By proceeding in a similar manner there was prepared from 5-amino-3-cyano-1-(2,6-dichloro-
10 4-trifluoromethylphenyl)-4-trifluoromethylsulphonylpyrazole and ethyl chloroformate:-

3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
5-bis(ethoxycarbonyl)amino-4-trifluoromethylsulphonylpyrazole, m.p. 116-116.9°C, in the form of a white
15 solid, after recrystallisation from toluene/hexane.

EXAMPLE 6

Compounds Nos. 31, 32, 33, 34, 35, 36, 93.

To a mixture of sodium hydride (0.71g of an 80% oil dispersion) in dry tetrahydrofuran (30ml) was added
20 5-amino-3-cyano-1-(2,6-dichloro-
4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole (4.0g). After 20 minutes, 3 drops of 15-crown-5 was added and the mixture cooled to 0°C. Methyl iodide (3.4g) was then added and the mixture stirred at 0°C
25 for $\frac{1}{2}$ hour, then at room temperature overnight. The

solvent was evaporated in vacuo and the residue partitioned between dichloromethane (80ml) and water (80ml). The organic phase was dried over anhydrous magnesium sulphate, and evaporated in vacuo to give a pale yellow solid (4.29g). Purification by chromatography eluting with dichloromethane/petroleum ether (1:1) gave 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-dimethylamino-4-trifluoromethylthiopyrazole (2.11g), m.p. 109.5-110.8°C, in the form of a white solid.

By proceeding in a similar manner but replacing the methyl iodide by the appropriate alkyl halides there was prepared:

3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-isopropylamino-4-trifluoromethylthiopyrazole, m.p. 173-175°C, in the form of a cream solid after purification by chromatography and recrystallisation from toluene/ hexane, prepared from isopropyl iodide.

3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-propylamino-4-trifluoromethylthiopyrazole, m.p. 162-163.5°C, in the form of a white solid, and:

3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-dipropylamino-4-trifluoromethylthiopyrazole, m.p. 72.5-73°C, in the form of a white solid, both compounds prepared using propyl bromide and performing the

reaction initially at 0°C and then at 70°C.

3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
5-bis(propargyl)amino-4-trifluoromethylthiopyrazole,
m.p. 86-89°C, in the form of a white solid after
5 recrystallisation from toluene/hexane, prepared from
propargyl bromide.

By proceeding in a similar manner but replacing the
5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-trifluoromethylthiopyrazole by 5-amino-
10 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-methanesulphonylpyrazole, and using methyl iodide as
alkylating agent, there was prepared:

3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
5-methylamino-4-methanesulphonylpyrazole in the form of
15 a yellow solid, m.p. 169-172°C.

By proceeding in a similar manner but replacing the
5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-trifluoromethylthiopyrazole by 5-amino-
3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
20 4-trifluoromethylsulphonylpyrazole and employing dioxan
as solvent and heating under reflux for 5 hours was
obtained 3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-5-dimethylamino-4-trifluoromethylsulphonyl-
pyrazole, m.p. 154-161°C, in the form of a white solid.

EXAMPLE 7

Compounds Nos. 37, 38, 39, 40, 41, 95.

A suspension of 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethanesulphonylpyrazole (43.8g) was stirred in a mixture of bromoform (141ml) and dry acetonitrile (63ml). Tert-butyl nitrite (29.9g) was added dropwise during 5 minutes, and the mixture heated at 60-70°C for 2.75 hours. After cooling to 25°C a further addition of tert-butyl nitrite (29.9g) was made, and the heating resumed for 2 hours. Evaporation in vacuo gave a yellow oily solid which was triturated with hexane and filtered off. Two recrystallisations from toluene/hexane gave 5-bromo-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethanesulphonylpyrazole as a yellow solid (34.0g), m.p. 136-137°C.

By proceeding in a similar manner but replacing the 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethanesulphonylpyrazole by the following phenylpyrazoles there was obtained:

5-Bromo-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole, m.p. 161.5-164°C, in the form of a buff solid, from 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole. Acetonitrile

was not employed as co-solvent for this preparation.

5-Bromo-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole, m.p. 160.5-162°C,

in the form of a white solid, from 5-amino-3-cyano-

5 1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-methanesulphonylpyrazole.

5-Amino-3-bromo-1-(2,6-dichloro-4-trifluoromethyl-

phenyl)-4-methanesulphonylpyrazole, m.p. 193-195°C, in

the form of a white solid, from 3,5-diamino-

10 1-(2,6-dichloro-4-trifluoromethylphenyl)-

4-methanesulphonylpyrazole (preparation described in

Reference Example 2), and by replacing the bromoform by

two equivalents of bromine and by employing chloroform
as solvent.

15 3-Bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)-

4-methanesulphonylpyrazole in the form of white

crystals, m.p. 178-180°C from 3-amino-1-(2,6-dichloro-
4-trifluoromethylphenyl)-4-methanesulphonylpyrazole.

By proceeding in a similar manner there was obtained:-

20 5-Bromo-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-trifluoromethylsulphonylpyrazole, m.p.

147-148°C, in the form of a yellow solid. The reaction
was performed at 52°C for 2 hours in this instance.

25

Reference Example 3

3-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-methanesulphonylpyrazole used in the Example above
was prepared as follows:

5 A solution of 3-tert-butoxycarbonylamino-
1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-methanesulphonylpyrazole (6.4g) in ethanol (150ml)
was treated with 50% v/v hydrochloric acid (20ml), and
the mixture refluxed for 1 hour. The solvent was
10 evaporated in vacuo and the residue dissolved in
dichloromethane, washed with sodium bicarbonate
solution, then with water, dried over anhydrous
magnesium sulphate and evaporated in vacuo. The
product was recrystallised from ethyl acetate/hexane to
15 give the title compound (3.0g) as white crystals, m.p.
222-223°C.

3-tert-Butoxycarbonylamino-1-(2,6-dichloro-
4-trifluoromethylphenyl)-4-methanesulphonylpyrazole was
prepared as follows:

20 A mixture of 3-carboxy-1-(2,6-dichloro-
4-trifluoromethylphenyl)-4-methanesulphonylpyrazole
(9.4g), and thionyl chloride (70ml) and N,N-dimethyl-
formamide (3 drops) was heated under reflux for 2
hours. The solvent was evaporated in vacuo and
25 re-evaporated in vacuo after addition of dry toluene

- (20ml). The resultant solid was dissolved in dry acetone (60ml) and stirred, whilst a solution of sodium azide (2.1g) in water (15ml) was added during 5 minutes keeping at 10-15°C. After 30 minutes the mixture was poured onto water (250ml) and extracted with dichloromethane (3 x 80ml). The combined extract was washed with water, dried over anhydrous magnesium sulphate, and evaporated in vacuo at equal to or below 40°C to give a fawn solid.
- 10 The resulting azide was dissolved in dry toluene (80ml) and heated under reflux for 0.75 hour, with smooth evolution of nitrogen. After cooling, this was treated with tert-butanol (15g), and the mixture heated under reflux for two hours. After standing overnight at room
- 15 temperature and evaporation in vacuo, the resulting brown semi solid (9.2g) was purified by chromatography on silica (Merck 230-400 mesh, 6.8Nm^{-2}) eluting with dichloromethane and ethyl acetate (98:2) to give the title compound (6.6g).
- 20 3-Carboxy-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole was prepared as follows: A mixture of 1-(2,6-dichloro-4-trifluoromethylphenyl)-3-ethoxycarbonyl-4-methanesulphonylpyrazole (14.0g) and 80% sulphuric acid (300ml) was heated and stirred at
- 25 80°C for 4 hours. After standing at room temperature

overnight, the solution was poured onto excess ice and the precipitated solid filtered off. This was dissolved in ethyl acetate, washed with water, dried (anhydrous magnesium sulphate) and evaporated to give the title compound as a buff solid (11.1g), m.p. 215-216°C.

1-(2,6-Dichloro-4-trifluoromethylphenyl)-3-ethoxycarbonyl-4-methanesulphonylpyrazole, used above, was prepared as follows:

To a solution of 5-amino-1-(2,6-dichloro-4-trifluoroethylphenyl)-3-ethoxycarbonyl-4-methanesulphonylpyrazole (17.1g) in dry tetrahydrofuran (130ml) stirred at room temperature, was added during 2 minutes, tert-butyl nitrite (33ml). The mixture was heated at reflux for 1.5 hours, the solvent evaporated in vacuo, and the residue dissolved in dichloromethane. After washing with water, drying (anhydrous magnesium sulphate), and evaporation a yellow solid was obtained. Recrystallisation from toluene-petroleum ether (b.p.60-80°C) gave the title compound as yellow crystals (15.2g), m.p. 183-185°C.

5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-ethoxycarbonyl-4-methanesulphonylpyrazole, used above, was prepared as follows:

To absolute ethanol (20ml) cooled in an ice-water bath was added sodium hydride (0.25g of an 80% oil dispersion), followed by methanesulphonylacetonitrile (0.99g) and the mixture stirred for $\frac{1}{2}$ hour. A solution
5 of ethyl chloro(2,6-dichloro-4-trifluoromethylphenyl)-hydrazonoacetate (3.0g) in absolute ethanol (20ml) was then added, and stirring continued for 5 hours. The yellow solid was filtered off (2.55g) and recrystallised from ethanol to give the title compound
10 as a colourless solid, m.p. 255°C.

Ethyl chloro(2,6-dichloro-4-trifluoromethylphenyl)-hydrazonoacetate was prepared as follows:

Sodium nitrite (3.04g) was added during 15 minutes to stirred concentrated sulphuric acid (24ml) at 30-50°C.
15 The solution was cooled to 20°C, and added dropwise during 15 minutes to a solution of 2,6-dichloro-4-trifluoro- methylaniline (9.2g) in acetic acid (90ml), maintaining at 35-40°C. This solution was then cooled to +10°, and added dropwise to
20 a stirred solution of anhydrous sodium acetate (54g) and ethyl chloroacetoacetate (7.0g) in a mixture of water (72ml) and ethanol (48ml) during 45 minutes with cooling such that the temperature was kept at 10°C. After 1 hour at room temperature the mixture was
25 diluted with water, filtered, and the solid dissolved

in dichloromethane. This solution was dried over anhydrous magnesium sulphate, filtered, and evaporated in vacuo to give the title compound as a white solid (11.9g), m.p. 96-98°C.

5 EXAMPLE 8

Compounds Nos. 42, 43, 44, 45.

A solution of 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole (4.0g) in dry tetrahydrofuran (20ml) was treated with
10 tert-butyl nitrite (5.76g) at room temperature. The mixture was then heated under reflux for 3 hours and evaporated in vacuo to give a yellow solid.

Purification by chromatography eluting with petroleum ether/ dichloromethane (2:1) gave

15 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole (3.12g), m.p. 126.5-128°C, in the form of a white solid.

By proceeding in a similar manner but replacing the 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole by the following
20 phenylpyrazoles, there was obtained:

3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethanesulphonylpyrazole, m.p. 149-151°C, in the form of a white solid, from 5-amino-3-cyano-
25 1-(2,6-dichloro-4-trifluoromethylphenyl)-

4-trifluoromethanesulphonylpyrazole. The product was obtained after 29 hours heating under reflux, followed by purification by chromatography and recrystallisation from toluene/hexane.

5 3-Cyano-1-(2,6-dichloro-4-trifluoromethoxyphenyl)-4-trifluoromethylthiopyrazole, m.p. 64-65°C, in the form of a white solid, from 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethoxyphenyl)-4-trifluoromethylthiopyrazole.

10 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole, m.p. 147-150°C, in the form of yellow crystals, from 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole.

15 EXAMPLE 9

Compounds Nos. 46, 47, 48, 49, 50, 94.

To a solution of 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole (3.0g) in chloroform (50ml) stirred at room temperature, was added iodine (3.61g). Tert-butyl nitrite (1.43g) was then added and after $\frac{1}{2}$ hour the mixture was heated under reflux for 2 hours, then left at room temperature overnight. The solid was filtered off, washed with dichloromethane (50ml) and the combined filtrate washed with sodium thiosulphate

20

- solution (2 x 50ml) and then with water (50ml). After drying over anhydrous magnesium sulphate, the solution was evaporated in vacuo to give a yellow solid (3.8g), which was purified by chromatography eluting with
- 5 petroleum ether/dichloromethane (2:1). Recrystallisation from toluene/hexane gave 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-iodo-4-trifluoromethylthiopyrazole, m.p. 187.3-188.3°C, in the form of a white solid.
- 10 By proceeding in a similar manner but replacing the 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole by the following phenylpyrazoles, there was obtained:
- 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
- 15 5-iodo-4-trifluoromethylsulphonylpyrazole, m.p. 180-181°C, in the form of a white solid; from 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethanesulphonylpyrazole. In this instance the reaction mixture was heated under reflux for 24
- 20 hours.
- 5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-iodo-4-methanesulphonylpyrazole, m.p. 226-227°C, in the form of a brown solid; from 3,5-diamino-1-(2,6-dichloro-4-trifluoromethylphenyl)-
- 25 4-methanesulphonylpyrazole. The reaction mixture was

heated under reflux for 4½ hours in this case.

1-(2,6-Dichloro-4-trifluoromethylphenyl)-3-iodo-4-methanesulphonylpyrazole, in the form of a cream solid, m.p. 150-151°C, prepared from 3-amino-

5 1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole (preparation described in Reference Example 3).

1-(2,6-Dichloro-4-trifluoromethylphenyl)-3-iodo-4-trifluoromethylthiopyrazole, m.p. 80-81.5°C, in the
10 form of a white solid, prepared from 3-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole.

The reaction was performed using dry acetonitrile as solvent and at a temperature of 0-5°C initially and
15 then at ambient temperature for ½ hour.

By proceeding in a similar manner there was obtained:-

3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-iodo-4-trifluoromethylsulphonylpyrazole, m.p. 165-166°C, in the form of a pale yellow solid; from
20 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylsulphonyl pyrazole.

Reference Example 4

3-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole, used in the above
25 Example was prepared as follows:

3-tert-Butoxycarbonylamino-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole (3.45g) dissolved in dry acetonitrile (80ml) was treated with iodotrimethylsilane (2.6g) added dropwise under nitrogen. After stirring for 45 minutes, methanol (10ml) was added, and after a further 15 minutes the solution was concentrated in vacuo to give a dark gum. This was dissolved in dichloromethane (100ml), washed with a solution of sodium sulphite (50ml), then with water (50ml) and dried over anhydrous magnesium sulphate. Evaporation of the dichloromethane gave the title compound (2.6g), m.p. 130-135°C, as an off white solid.

3-tert-Butoxycarbonylamino-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole used above, was prepared as follows:

1-(2,6-Dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole-3-carboxylic acid (5.6g) was dissolved in dry N,N-dimethylformamide (50ml) and triethylamine (1.33g) added. After cooling to 5°C, a solution of diphenylphosphorylazide (3.63g) in N,N-dimethylformamide (20ml) was added. When the solution had reached ambient temperature, it was heated to 35°C for 2½ hours. After evaporation in vacuo at a temperature kept below 40°C, a solution of sodium

chloride (5g) in water (100ml) was added, and the suspension extracted with ether (3 x 100ml). The combined extracts were washed with water (50ml), dried over anhydrous magnesium sulphate and evaporated to give 1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole-3-carboxylic acid azide (5.4g). A solution of this in dry toluene (200ml) was heated under reflux with stirring for 1.5 hours, tert-butanol (35ml) was added, and reflux continued for 4 hours. After evaporation in vacuo the residue was purified by chromatography eluting with dichloromethane to give the title compound (3.3g) as an off-white solid, m.p. 122-125°C.

1-(2,6-Dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole-3-carboxylic acid used above, was prepared as follows:

A solution of sodium hydroxide (1.73g) in water (50ml) was added to a suspension of 1-(2,6-dichloro-4-trifluoromethylphenyl)-3-ethoxycarbonyl-4-trifluoromethylthiopyrazole (6.8g) in ethanol (70ml), and the mixture heated under reflux for 1½ hours. The solvent was evaporated in vacuo, water (250ml) added, followed by concentrated sulphuric acid to pH1. The product was filtered off, washed with water (100ml) and dried at 120°C in vacuo giving the title compound (5.7g) as a grey solid, m.p. 175-177°C.

1-(2,6-Dichloro-4-trifluoromethylphenyl)-
3-ethoxycarbonyl-4-trifluoromethylthiopyrazole used
above, was prepared by following the procedure of
Example 8 by replacing the 5-amino-
3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-trifluoromethylthiopyrazole by
5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-
3-ethoxycarbonyl-4-trifluoromethylthiopyrazole. The
title compound was obtained as an off white solid, m.p.
125.5-126°C.

5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-
3-ethoxycarbonyl-4-trifluoromethylthiopyrazole used
above, was prepared by the procedure described in
Example 1, and obtained in the form of a white solid,
m.p. 213-214°C after purification by chromatography;
from 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-
3-ethoxycarbonylpyrazole.

5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-
3-ethoxycarbonylpyrazole was prepared as follows:
A solution of 3-cyano-2-hydroxyprop-2-enoic acid ethyl
ester sodium salt (50.0g) [C.A.57:16604d N.S. Vulfson
et al] in cold water (500ml) was stirred whilst cold
sulphuric acid (2N) was added to pH1. The solution was
extracted with ether (2 x 400ml) and the extract washed
with water (200ml), dried over anhydrous magnesium

5 sulphate, and evaporated in vacuo to give a yellow oil (29.4g). A solution of this in ethanol (400ml) was treated with 2,6-dichloro-4-trifluoromethylphenylhydrazine (51.1g), and the solution heated under reflux overnight. After cooling, the solution was evaporated in vacuo to give an orange solid. Recrystallisation from toluene/hexane gave the title compound as a fawn solid (40.2g), m.p. 179-181°C.

EXAMPLE 10

10 Compounds Nos. 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 91.

15 A partial solution of 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole (48.0g) in chloroform (600ml) was stirred mechanically and treated with m-chloroperbenzoic acid (61.4g). The mixture was stirred and heated under reflux in an atmosphere of nitrogen for 3.5 hours. After cooling, an additional amount of m-chloroperbenzoic acid (12.3g) was added, and reflux continued for 1 hour. The cooled mixture was diluted with ethyl acetate (600ml), washed with a solution of sodium metabisulphite (2 x 250ml), then with sodium hydroxide solution (2 x 250ml) and finally with water (1 x 500ml). The organic layer was dried over anhydrous magnesium sulphate, filtered, and
20 evaporated in vacuo to give a fawn solid.
25

Recrystallisation from toluene/hexane/ethyl acetate gave 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethanesulphonylpyrazole as white crystals (37.0g) m.p. 219-221.5°C.

- 5 A stirred solution of 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole (10.0g) in dichloromethane (100ml) was treated with m-chloroperbenzoic acid (4.5g). After stirring overnight additional m-chloroperbenzoic acid (1.6g) was
- 10 added in 2 portions, and left for 2 days. The reaction product was diluted with ethyl acetate (30ml) and then washed in turn with sodium sulphite solution (50ml), sodium carbonate solution (50ml) and with water (50ml). After drying over magnesium sulphate, this was filtered
- 15 and evaporated in vacuo. Purification by chromatography on silica eluting with dichloromethane gave 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylsulphonylpyrazole as a white solid (6.0g), m.p. 200.5-201°C.
- 20 By proceeding in a similar manner and by replacing the abovementioned phenylpyrazoles by the appropriate phenylpyrazoles there was prepared:
- 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethoxyphenyl)-4-trifluoromethane-sulphonylpyrazole, m.p.
- 25 210-211.5°C, in the form of a white solid, and

5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethoxy-phenyl)-4-trifluoromethylsulphonylpyrazole, m.p. 179-180°C, in the form of a white solid.

Both of the above two compounds being prepared from

5 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethoxy-phenyl)-4-trifluoromethylthiopyrazole by the use of an appropriate quantity of m-chloroperbenzoic acid.

3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylsulphonylpyrazole, m.p. 142.5-144.2°C, 10 in the form of a white solid, from 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole and by performing the reaction at 40-50°C for 20 hours.

5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-(1-methylprop-2-ynylsulphonyl)pyrazole, 15 136.6-137.2°C, in the form of a white solid, from 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-(1-methylprop-2-ynylthio)pyrazole.

5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-methylsulphonylpyrazole, m.p. 176-177°C, in 20 the form of a fawn crystalline solid; prepared from 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-methylthiopyrazole.

5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-isopropylsulphonylpyrazole, m.p. 187-188°C, 25

in the form of a white solid; prepared from 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-isopropylthiopyrazole.

5 5-Amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylsulphonylpyrazole, m.p. 179-180°C, in the form of a white solid; prepared from 5-amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole.

10 5-Amino-4-tert-butan sulphonyl-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole, m.p. 183-184°C, in the form of a pale yellow solid; prepared from 5-amino-4-tert-butylthio-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole employing 2 molar equivalents of m-chloroperbenzoic acid in chloroform and at room temperature for 4 hours.

15 By proceeding in a similar manner there was prepared:-
5-Amino-3-chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethanesulphonylpyrazole, m.p. 162-164°C, in the form of a white solid, from 5-amino-3-chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole.

20 3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-propylamino-4-trifluoromethanesulphonylpyrazole, m.p. 49-65°C, in the form of a yellow solid; prepared from
25 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-

5-propylamino-4-trifluoromethylthiopyrazole at room temperature.

5-Acetamido-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethanesulphonylpyrazole, m.p.

5 174-175.9°C, in the form of a white solid; prepared from 5-acetamido-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole employing 2 molar equivalents of m-chloroperbenzoic acid and heating under reflux in chloroform for 20 hours.

10 EXAMPLE 11

Compounds Nos. 63, 64.

Trifluoroacetic anhydride (6.0ml) was added dropwise during 15 minutes to a stirred mixture of 85% hydrogen peroxide (0.96ml) in dichloromethane (20ml) at 0-10°C.

15 The mixture was warmed to 20°C for 5 minutes, and a suspension of 3-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole (2.0g) in dichloromethane (20ml) was added during 5 minutes. The solution was then heated under reflux for 1 hour and
20 left at room temperature overnight. This was poured onto water (100ml) and the organic layer washed in turn with sodium metabisulphite solution (30ml) and sodium bicarbonate solution (30ml), and then dried over anhydrous magnesium sulphate. Evaporation in vacuo
25 gave, after recrystallisation from dichloromethane/

toluene/hexane, 1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-methanesulphonyl-3-nitropyrazole, m.p. 190-192°C, in the form of a white solid.

By proceeding in a similar manner but replacing the
5 3-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole by 3,5-diamino-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole there was prepared:
5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-
10 4-methanesulphonyl-3-nitropyrazole in the form of a cream solid, m.p. 190-192°C. The oxidation was performed initially at 0°C and then warmed to room temperature for 1.5 hours. Purification by chromatography eluting with dichloromethane, and
15 recrystallisation from toluene was necessary in this case.

EXAMPLE 12

Compound No. 65.

A stirred mixture of 85% hydrogen peroxide (0.31g) and
20 dichloromethane (20ml) was treated with trifluoroacetic anhydride (2.1g) dropwise at -10°C. After 15 minutes the mixture was allowed to reach room temperature, and stirred for a further 15 minutes. After re-cooling to 0°C, a solution of 3-amino-1-(2,6-dichloro-4-trifluoro-
25 methylphenyl)-4-trifluoromethylthiopyrazole (1.0g)

[preparation described in Reference Example 4] in dichloromethane (20ml) was added, and the solution allowed to warm to room temperature. After 2 hours, an additional quantity of trifluoroacetic acid
5 [prepared as above using 85% hydrogen peroxide (0.31g); dichloromethane (20ml) and trifluoroacetic anhydride (2.1g)] was added. The mixture was stirred overnight, then poured onto water (50ml), and the dichloromethane layer washed in turn with 5% sodium sulphite solution
10 (30ml), sodium bicarbonate solution (30ml) and with water (30ml). This solution was then dried over anhydrous magnesium sulphate, and evaporated in vacuo to give a green gum (0.8g). Purification by chromatography eluting with dichloromethane/hexane
15 (3:2) gave 1-(2,6-dichloro-4-trifluoromethylphenyl)-3-nitro-4-trifluoromethylsulphonylpyrazole (0.3g), m.p. 124-130°C, in the form of a pale green solid.

EXAMPLE 13

Compounds Nos. 66, 67.

20 Phosphorus oxychloride (20ml) was added to 5-amino-1-(2-bromo-6-chloro-4-trifluoromethylphenyl)-3-carbamoyl-4-methanesulphonylpyrazole (4.0g) and the solution heated at 50-60°C for 3.25 hours, and left at room temperature overnight. The mixture was cautiously
25 added to vigorously stirred water (200ml), and the

precipitated solid collected and dried in vacuo.

Recrystallisation from toluene/ethanol gave

5-amino-1-(2-bromo-6-chloro-4-trifluoromethylphenyl)-
3-cyano-4-methanesulphonylpyrazole as buff crystals,
5 m.p. 235-238°C.

By proceeding in a similar manner to that described
above but replacing the 5-amino-1-(2-bromo-6-chloro-
4-trifluoromethylphenyl)-3-carbamoyl-

4-methylsulphonylpyrazole by 5-amino-3-carbamoyl-
10 1-(2,6-dichloro-4-trifluoromethoxyphenyl)-
4-methanesulphonylpyrazole there was obtained:

5-Amino-1-(2,6-dichloro-4-trifluoromethoxyphenyl)-
3-cyano-4-methanesulphonylpyrazole in the form of a
white solid, m.p. 202.5-203.5°C.

15 Reference Example 5

5-Amino-3-carbamoyl-1-(2,6-dichloro-4-trifluoromethoxy-
phenyl)-4-methanesulphonylpyrazole, used above, was
prepared as follows:

suspension of 5-amino-3-carboxy-1-(2,6-dichloro-
20 4-trifluoromethoxyphenyl)-4-methanesulphonylpyrazole
(40.0g) in toluene (160ml) was treated with thionyl
chloride (150ml) and the mixture heated under reflux
with stirring for 3 hours. The solution was evaporated
in vacuo and re-evaporated after addition of toluene
25 (100ml). The resultant acid chloride was dissolved in

tetrahydrofuran (200ml) and this solution added dropwise during 15 minutes to stirred ammonia solution (300ml), with cooling at 5-10°C throughout. After standing overnight, water (250ml) was added and the
5 solution extracted with ethyl acetate (3 x 100ml). The combined extract was washed with water (2 x 250ml), dried over anhydrous magnesium sulphate, and evaporated in vacuo to give a solid (34.9g). The title compound (19.3g) was obtained in the form of a white solid, m.p.
10 219-220°C, after recrystallisation from ethyl acetate/hexane.

By proceeding in a similar manner but replacing the 5-amino-3-carboxy-1-(2,6-dichloro-4-trifluoromethoxyphenyl)-4-methanesulphonylpyrazole by
15 5-amino-1-(2-bromo-6-chloro-4-trifluoromethylphenyl)-3-carboxy-4-methanesulphonylpyrazole there was obtained:
5-Amino-1-(2-bromo-6-chloro-4-trifluoromethylphenyl)-3-carbamoyl-4-methanesulphonylpyrazole, m.p. 250-253°C,
20 in the form of a grey-brown powder.

5-Amino-3-carboxy-1-(2,6-dichloro-4-trifluoromethoxyphenyl)-4-methanesulphonylpyrazole, used above, was prepared by using the method employed to prepare 3-carboxy-1-(2,6-dichloro-4-trifluoromethylphenyl)-
25 4-methanesulphonylpyrazole by replacing the

1-(2,6-dichloro-4-trifluoromethylphenyl)-
3-ethoxycarbonyl-4-methanesulphonylpyrazole (Reference
Example 3) by 5-amino-1-(2,6-dichloro-
4-trifluoromethoxyphenyl)-3-ethoxycarbonyl-
5 4-methanesulphonylpyrazole. It was obtained in the
form of a white solid, m.p. 195-196°C.
5-Amino-1-(2-bromo-6-chloro-4-trifluoromethylphenyl)-
3-carboxy-4-methanesulphonylpyrazole, used above, was
prepared as follows:
10 5-Amino-1-(2-bromo-6-chloro-4-trifluoromethylphenyl)-
3-ethoxycarbonyl-4-methanesulphonylpyrazole (8.0g) was
heated under reflux with 48% hydrobromic acid (75ml) in
acetic acid (75ml) for 3 hours. After cooling
overnight, this was evaporated in vacuo, and the
15 residue triturated with aqueous sodium bicarbonate.
The title compound was obtained as a grey powder
(6.6g), m.p. 130-133°C, after drying in vacuo.
5-Amino-1-(2,6-dichloro-4-trifluoromethoxyphenyl)-
3-ethoxycarbonyl-4-methanesulphonylpyrazole, used
20 above, was prepared by the procedure of Reference
Example 3 by replacing ethyl chloro (2,6-dichloro-
4-trifluoromethylphenyl)hydrazonoacetate by ethyl
chloro (2,6-dichloro-4-trifluoromethoxyphenyl)-
hydrazonoacetate. It was obtained in the form of a
25 light brown solid, m.p. 207°C.

5-Amino-1-(2-bromo-6-chloro-4-trifluoromethylphenyl)-
3-ethoxycarbonyl-4-methanesulphonylpyrazole, used
above, was prepared similarly from ethyl chloro
(2-bromo-6-chloro-4-trifluoromethylphenyl)-
5 hydrazonoacetate. It was obtained as a white solid,
m.p. 255.5-256.5°C.

Ethyl chloro (2,6-dichloro-4-trifluoromethoxyphenyl)-
hydrazonoacetate, used above, was prepared by the
procedure of Reference Example 3 by replacing
10 2,6-dichloro-4-trifluoromethylaniline by
2,6-dichloro-4-trifluoromethoxyaniline, and was
obtained as a brown solid, m.p. 55-58°C.

Ethyl chloro (2-bromo-6-chloro-4-trifluoromethyl-
phenyl)hydrazonoacetate, used above, was prepared
15 similarly from 2-bromo-6-chloro-
4-trifluoromethylaniline, and was obtained as a buff
solid, m.p. 116.5-117.5°C.

EXAMPLE 14

Compound No. 68.

20 A solution of sodium ethoxide prepared from sodium
(0.36g) and absolute ethanol (50ml) was treated at room
temperature with methanesulphonyl acetonitrile (1.88g)
and stirred for 1 hour. To this was then added
dropwise with stirring, a solution of
25 1-chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)-

hydrazonopropan-2-one (5.0g) in ether (50ml). After stirring overnight the solution was diluted with water (100ml), extracted with ether (3 x 50ml), and the combined ethereal extracts dried over anhydrous magnesium sulphate, and evaporated in vacuo to give a brown solid. Recrystallisation from toluene/hexane gave 3-acetyl-5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole (2.56g) in the form of a buff solid, m.p. 176.7-178.9°C.

1-Chloro-1-(2,6-dichloro-4-trifluoromethylphenyl)hydrazonopropan-2-one, used above, was prepared by the procedure described in Reference Example 3, but replacing the ethyl chloroacetoacetate by 3-chloropentan-2,4-dione. It was obtained in the form of a light brown solid, m.p. 77-79°C, after recrystallisation from petroleum ether b.p. 60-80°C.

EXAMPLE 15

Compounds Nos. 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 100.

A solution of 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-thiocyanatopyrazole (3.1g) in methanol (50ml) was stirred under nitrogen at -7°C and methyl iodide (5.25ml) added. A solution of potassium hydroxide (0.92g) in water (10ml) was then

- added dropwise during 10 minutes, keeping the mixture below 0°C. After stirring at room temperature for 3 hours, the mixture was neutralised by the addition of carbon dioxide pellets, followed by water (180ml). The precipitated solid was filtered off, and recrystallised from toluene/hexane (2:1). 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methylthiopyrazole was obtained as a brown crystalline solid (1.94g), m.p. 170-172°C.
- By proceeding in a similar manner but replacing the methyl iodide by the following alkyl halides there was obtained:
- 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-ethylthiopyrazole in the form of a yellow solid, m.p. 158-160°C, by using ethyl iodide and aqueous ethanol as solvent.
- 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-propylthiopyrazole in the form of a pale brown solid, m.p. 123-124°C, by using propyl bromide and aqueous dioxan as solvent.
- 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-isopropylthiopyrazole in the form of a pale brown solid, m.p. 168-169°C, by using isopropyl bromide and aqueous isopropyl alcohol as solvent.

5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-(2-methylpropylthio)pyrazole in the form of a pale brown solid, m.p. 134-137°C, by using 1-iodo-2-methylpropane and aqueous dioxan as solvent.

5 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-(1-methylpropylthio)pyrazole in the form of a pale brown solid, m.p. 152.5-154°C, by using 2-iodobutane and aqueous dioxan as solvent. The product was purified by dry column chromatography on silica eluting with hexane/diethylether (1:1).

10 4-Allylthio-5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole in the form of a pale brown solid, m.p. 140-141°C, by using allyl bromide and aqueous dioxan as solvent. The product was purified by chromatography eluting with hexane/diethyl ether (1:1), followed by recrystallisation from toluene.

15 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-(prop-2-ynylthio)pyrazole in the form of a brown solid, m.p. 161-163°C, by using propargyl bromide and aqueous methanol as solvent.

20 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-phenyl)-4-(1-methylprop-2-ynylthio)pyrazole in the form of a white solid, m.p. 134-135.6°C, by using 3-bromobut-1-yne and aqueous methanol as solvent. The product was purified by chromatography eluting with

25

diethyl ether/hexane (1:1), followed by
recrystallisation from toluene/hexane.

5-Amino-3-bromo-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-methylthiopyrazole in the form of a white
5 solid, m.p. 117-119°C, by using methyl iodide and
aqueous methanol as solvent. The product was purified
by chromatography eluting with dichloromethane.
By proceeding in a similar manner there was prepared:
5-Amino-4-(2-chloro-1,1,2-trifluoroethylthio)-3-cyano-
10 1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole, m.p.
116-118°C, in the form of a white solid, by using
chlorotrifluoroethylene and aqueous dioxan as solvent.
The product was purified by chromatography eluting with
dichloromethane, and subsequent recrystallisation from
15 toluene/hexane (3:10).

Reference Example 6

5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-thiocyanatopyrazole, used above, was prepared
as follows:

20 A suspension of potassium thiocyanate (4.99g) in
methanol (75ml) was stirred at -78°C. Bromine (0.8ml)
dissolved in methanol (10ml) was then added dropwise
during 25 minutes. After a further 20 minutes, a
solution of 5-amino-3-cyano-1-(2,6-dichloro-
25 4-trifluoromethylphenyl)pyrazole (5.0g) in methanol

(50ml) was then added over 30 minutes. The mixture was stirred at -78°C and then allowed to warm to room temperature for 3 hours, before pouring onto water (250ml). The precipitated solid was filtered off, washed with water, and recrystallised from toluene/hexane to give the title compound (3.1g) as a white solid, m.p. 179-182°C.

By proceeding in a similar manner but replacing the 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole in the above Reference Example by 5-amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole, there was obtained:

5-Amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-thiocyanatopyrazole in the form of a white solid, m.p. 162-163.5°C, after purification by chromatography, eluting with dichloromethane.

The preparation of 5-amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)pyrazole, used above, is described in Reference Example 1.

EXAMPLE 16

Compound No. 79.

To a stirred solution of 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-thiocyanatopyrazole (5.0g) in dry diethyl ether (70ml) at 0°C under an atmosphere of nitrogen, was

added dropwise a solution of tert- butylmagnesium chloride (7.92ml of a 2M solution in dry ether). The solution was then allowed to reach room temperature, and the stirring continued for 3 hours.

5 Water (40ml) was then added and the mixture stirred for 15 minutes. The ethereal layer was separated, washed with water (50ml), dried over anhydrous magnesium sulphate, and evaporated in vacuo to give a brown solid. Purification by chromatography eluting with

10 dichloromethane/petroleum ether (3:1) gave 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-tert-butylthiopyrazole (2.62g), m.p. 196-198.5°C, in the form of a pale yellow solid.

EXAMPLE 17

15 Compounds Nos. 80, 81.

A solution of 5-amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methylthiopyrazole (2.0g) [preparation described in Example 15] in methanol (45ml) at -25°C was treated with a rapidly added

20 solution of potassium hydrogen persulphate (1.66g), followed immediately by the addition of water (22ml). The mixture was stirred for 30 minutes at 0°C, and potassium hydrogen persulphate (0.4g) added. After 2½ hours stirring at room temperature, the mixture was

25 poured onto water (300ml) and saturated sodium

- bisulphite solution (35ml) added. This was extracted with dichloromethane (2 x 150ml) and the extract washed with water (2 x 50ml), dried over anhydrous magnesium sulphate, and evaporated in vacuo. The crude product
- 5 was purified by chromatography eluting with dichloromethane/ethyl acetate (4:1) to give 5-amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methylsulphonylpyrazole (0.9g) as a white solid, m.p. 135-136°C.
- 10 By proceeding in a similar manner but replacing the 5-amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methylthiopyrazole by 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-ethylthiopyrazole and by utilising an appropriate
- 15 quantity of potassium hydrogen persulphate there was obtained:
- 5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-ethanesulphonylpyrazole in the form of a yellow solid, m.p. 180-183°C. In this case the
- 20 reaction mixture was kept at room temperature for 20 hours, and gave the title compound without chromatographic purification.

EXAMPLE 18

Compound No. 82.

A solution of 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-ethoxymethyleneamino-4-trifluoromethylthiopyrazole (1.7g) in methanol (30ml) was stirred, and sodium borohydride (1.08g) added portionwise. The solution was allowed to reach room temperature, and after a further 7 hours was poured onto water (200ml). This was extracted with dichloromethane (3 x 50ml), dried over anhydrous magnesium sulphate, and evaporated in vacuo to give a white solid (1.4g). Purification by chromatography eluting with dichloromethane/petroleum ether (4:1) gave 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-methylamino-4-trifluoromethylthiopyrazole (0.42g) in the form of a white solid, m.p. 208.5-209.5°C.

EXAMPLE 19

Compound No. 83.

To a solution of 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-ethoxycarbonylamino-4-trifluoromethylthiopyrazole (1.0g) in dry tetrahydrofuran (20ml) was added sodium hydride (0.095g) with stirring at 0-10°C. After stirring at room temperature for 2½ hours, methyl iodide (0.6g) was added dropwise with cooling at 0-10°C, and the mixture stirred overnight. Additional

methyl iodide (0.6g) was added and stirring continued for 8½ hours. The solution was poured onto water (100ml) and extracted with dichloromethane (2 x 50ml). The extracts were dried over anhydrous magnesium sulphate and evaporated in vacuo to give 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-(N-ethoxycarbonyl-N-methyl)amino-4-trifluoromethylthiopyrazole (0.81g), m.p. 86.2-88.5°C, in the form of a white solid.

10 EXAMPLE 20

Compound No. 84.

A mixture of 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole (3.0g) and trifluoroacetic anhydride (15.0g) in tetrahydrofuran (25ml) was heated under reflux for 6 hours. After standing overnight the mixture was evaporated in vacuo, dissolved in dichloromethane (50ml) and washed with sodium bicarbonate solution (50ml) and with water (50ml). The solution was dried over anhydrous magnesium sulphate and evaporated in vacuo to give a brown oil (2.9g). Trituration with hexane then gave 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-trifluoroacetamido-4-trifluoromethylthiopyrazole (1.86g), m.p. 138.2-139.8°C, in the form of a white solid.

EXAMPLE 21

Compounds Nos. 85, 98.

A solution of 3-cyano-1-(2,6-dichloro-4-trifluoro-
methylphenyl)-5-bisethoxycarbonyl)amino-
5 4-trifluoromethylthiopyrazole (1.8g) in ethanol (20ml)
was treated with a saturated solution of sodium
bicarbonate (20ml), and the mixture heated under reflux
for 1½ hours. After evaporation in vacuo the yellow
oil was distributed between dichloromethane (70ml) and
10 water (70ml). The aqueous layer was re-extracted with
dichloromethane (50ml) and the combined organic
solution dried over anhydrous magnesium sulphate, and
evaporated in vacuo. Trituration with hexane then gave
3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
15 5-ethoxycarbonylamino-4-trifluoromethylthiopyrazole
(1.23g), m.p. 108.7-109.7°C, in the form of a white
solid.

By proceeding in a similar manner there was prepared
from 3-cyano-1-(2,6-dichloro-4-trifluoromethyl-
20 phenyl)-5-bis(ethoxycarbonyl)amino-4-trifluoromethyl-
sulphonylpyrazole:

3-Cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
5-ethoxycarbonylamino-4-trifluoromethylsulphonyl-
pyrazole, m.p. 112.4-113°C, in the form of a white
25 solid, and after purification by chromatography eluting
with dichloromethane/hexane (1:1).

EXAMPLE 22

Compound No. 86

To a solution of 1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-3-(1-hydroxyethyl)-4-trifluoromethylthio-
5 pyrazole (1.1g) in dichloromethane (40ml) was added
pyridinium chlorochromate (0.62g), and the mixture
stirred at room temperature overnight. Ether (50ml)
was added and the mixture filtered diatomaceous earth.
Evaporation of the filtrate in vacuo gave a brown
10 solid, which was triturated with hexane and filtered.
The filtrate was evaporated in vacuo to give a yellow
solid, which recrystallised from cyclohexane to give
3-acetyl-1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-trifluoromethylthiopyrazole (0.4g) in the form of a
15 yellow solid, m.p. 89-91°C.

Reference Example 7

1-(2,6-Dichloro-4-trifluoromethylphenyl)-
3-(1-hydroxyethyl)-4-trifluoromethylthiopyrazole used
in the above Example was prepared as follows:
20 A stirred solution of 1-(2,6-dichloro-
4-trifluoromethylphenyl)-3-formyl-
4-trifluoromethylthiopyrazole (1.64g) in dry ether
(20ml) was treated with a solution of methyl magnesium
iodide (1.35ml of a 3M solution in ether) added
25 dropwise during 5 minutes under nitrogen. The solution

was then heated under reflux for 1½ hours, after which time it was cooled and treated with an additional portion of methyl magnesium iodide solution (0.2ml) in the same manner as before. After another 1 hour of reflux, the mixture was poured onto excess ice and dilute hydrochloric acid (100ml) and extracted with ether (2 x 50ml). The extract was washed with sodium bicarbonate solution (50ml), and with water (50ml) and dried over anhydrous magnesium sulphate. Evaporation in vacuo gave the title compound (1.46g), in the form of a yellow oil.

EXAMPLE 23

Compound No. 87

A stirred solution of 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole (2.03g) in dry tetrahydrofuran (20ml) was treated with a solution of diisobutyl aluminium hydride (10ml of a 1.0M solution in toluene) which was added dropwise under nitrogen at -60 to 70°C during 10 minutes. The solution was allowed to warm to room temperature for 3 hours and then at -10°C overnight. After pouring onto ice and 2N sulphuric acid (100ml) and stirring for ½ hour, the mixture was extracted into dichloromethane (3 x 25ml). The extract was washed with water (50ml), dried over anhydrous magnesium sulphate, and evaporated

in vacuo to give a yellow oil (1.8g). Purification by chromatography eluting with dichloromethane/hexane (1:1) gave 1-(2,6-dichloro-4-trifluoromethylphenyl)-3-formyl-4-trifluoromethylthiopyrazole (1.5g) in the form of a white solid, m.p. 79-81°C.

EXAMPLE 24

Compound No. 88

A solution of 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylthiopyrazole (2.0g) in formic acid (90%, 50ml) was heated under reflux with Raney nickel (2.0g), cooled and heating continued for 5 hours after a further addition of Raney nickel (2.0g). The filtered mixture was diluted with water (250ml) and extracted with dichloromethane (4 x 50ml). The extract was washed with sodium bicarbonate solution (2 x 50ml), dried over anhydrous magnesium sulphate, and evaporated in vacuo to give a solid (1.0g). Purification by chromatography eluting with dichloromethane gave 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-formyl-4-trifluoromethylthiopyrazole (0.05g), m.p. 140-143°C, in the form of yellow crystals, after recrystallisation from toluene/hexane.

EXAMPLE 25

Compound No. 89

A mixture of dry sulpholane (15ml) and 4Å molecular sieve (3.0g) was stirred under nitrogen with caesium fluoride (2.4g) at 60°C for $\frac{1}{2}$ hour. To this was added 5-bromo-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethanesulphonylpyrazole (2.0g) and the mixture stirred at 60°C for 2 hours, and left overnight at room temperature. This was diluted with ether (50ml), filtered, and washed with water (100ml). The aqueous layer was re-extracted with ether (3 x 50ml) and the combined organic solution re-washed with water (4 x 50ml), dried over anhydrous magnesium sulphate, and evaporated in vacuo to give an oil. Purification by chromatography, eluting with ether/hexane (1:4) gave 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-fluoro-4-trifluoromethanesulphonylpyrazole (0.17g), m.p. 95-98°C, in the form of a white solid, after recrystallisation from hexane.

EXAMPLE 26

Compound No. 92

A solution of pentafluoroethyl iodide (5.0g) in dry ether (30ml) was stirred at -78°C, whilst a solution of phenylmagnesium bromide (0.02mol) in dry ether (20ml)

and a separate solution of 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-thiocyanatopyrazole (7.6g) in dry ether (75ml) were added simultaneously dropwise during 2.5 hours. The mixture was allowed to reach room temperature, and after a further 0.5 hour, was treated with a solution of hydrochloric acid (2M, 15ml) at 0°C. The ethereal layer was dried over anhydrous magnesium sulphate, and evaporated in vacuo to give a brown gum (8.8g).

Purification by dry column flash chromatography eluting with dichloromethane/petroleum ether (1:1) gave 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-pentafluoroethylthiopyrazole, m.p. 134.5-136.5°C, in the form of a yellow solid.

EXAMPLE 27

Compound No. 101

To a solution of 5-bromo-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-trifluoromethylsulphonylpyrazole (1.5g) in dioxan (20ml) there was added 1,1-dimethylhydrazine (0.62g) and the mixture heated to 60°C for 4.25 hours. After pouring onto water (20ml) the aqueous layer was extracted with dichloromethane (2x50ml) and this extract combined with the dioxan layer, washed with water (1x50ml) dried over anhydrous magnesium sulphate, and evaporated in vacuo to give a

solid (1.4g). Purification by chromatography eluting with dichloromethane/hexane (1:1) gave 3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-5-dimethylamino-4-trifluoromethylsulphonylpyrazole
5 (0.35g), m.p. 178-179°C, in the form of a white solid.

EXAMPLE 28

Compounds Nos 1, 13 and Intermediate in Reference

Example 4

To a stirred solution of
5 5-amino-3-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-
pyrazole (2.23 g) and pyridine (0.55 g) in chloroform
(50 ml) was added dropwise at 0°C, a solution of
trifluoromethylsulphenyl chloride (1.24 g) in
chloroform (15 ml) during 20 minutes. The mixture was
10 stirred at 0°C for 3 hours, and the solvent evaporated
in vacuo to give a yellow solid (3.1 g). This was
purified by chromatography on silica (Merck, 230-400
mesh, 0.7 kgcm⁻²) eluting with dichloromethane and
petroleum ether b. 40-60° (3:1) to give 5-amino-1-
15 (2,6-dichloro-4-trifluoromethylphenyl)-3-cyano-
4-trifluoromethylthiopyrazole in the form of a white
solid (2.33 g), m.p. 169.5-170.5°C.

By proceeding in a similar manner to that described
above but replacing the
20 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-
3-cyanopyrazole by the following phenylpyrazoles there
was obtained:-

5-Amino-3-bromo-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-trifluoromethylthiopyrazole in the form of a
25 colourless solid, m.p. 154.5-156°C, from
5-amino-3-bromo-1-(2,6-dichloro-4-trifluoromethylphenyl)-
pyrazole.

5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-
4-trifluoromethylthiopyrazole-3-carboxylic acid ethyl
ester in the form of a white solid, m.p. 213-215°C from
5-amino-1-(2,6-dichloro-4-trifluoro-
5 methylphenyl)-3-ethoxycarbonylpyrazole.

5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-
3-ethoxycarbonylpyrazole used in the above example was
prepared as follows:-

A solution of 3-cyano-2-hydroxyprop-2-enoic acid
10 ethyl ester sodium salt (50.0 g) in cold water (500 ml)
was stirred and acidified to pH 1 with cold dilute
sulphuric acid. Sodium chloride (50 g) was added and
the solution extracted with ether (2 x 200 ml). This
extract was washed with water (50 ml), dried (anhydrous
15 magnesium sulphate), and evaporated to give a yellow
liquid (30.2 g). This was dissolved in ethanol
(400 ml) and stirred whilst 2,6-dichloro-4-trifluoro-
methylphenylhydrazine (52.5 g) was quickly added. The
solution was then heated under reflux overnight,
20 cooled, and evaporated in vacuo to give an orange
solid. After trituration with hexane (300 ml), the
filtered solid was recrystallised from toluene-hexane
with charcoaling to give the title compound (43.4 g),
m.p. 177-179°C as buff crystals.

REFERENCE EXAMPLE 8

A solution of 2,6-dichloro-4-trifluoromethylphenylhydrazine (10.1 g) in tetrahydrofuran (50 ml) was stirred at room temperature, and potassium carbonate (anhydrous, 8.5 g) added. To this was added, dropwise at 0°C, a solution of 2-chloro-3-cyano-3-(1-methyl)-ethylsulphonylprop-2-enoic acid ethyl ester (11.0 g) in tetrahydrofuran (100 ml). After stirring for 2 hours, the mixture was filtered, and the filtrate evaporated in vacuo to give a brown oil. After trituration with hexane (100 ml) this gave an off white solid (11.7 g). After refluxing this in ethanol and cooling there was obtained 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-ethoxycarbonyl-4-(1-methyl)-ethylsulphonyl pyrazole (8.5 g), m.p. 255.5-256.5°C as white crystals.

REFERENCE EXAMPLE 9

2-Chloro-3-cyano-3-(1-methyl)ethylsulphonylprop-2-enoic acid ethyl ester used above was prepared as follows:-

3-Cyano-2-hydroxy-3-(1-methyl)ethylsulphonylprop-2-enoic acid ethyl ester sodium salt (10.0 g) was added to the stirred phosphorus oxychloride (28.5 g) at room temperature. After 3 hours the mixture was heated at 50°C for 1 hour, and then evaporated in vacuo. The residue was re-evaporated after addition of toluene to give the title compound as a brown oil.

3-Cyano-2-hydroxy-3-(1-methyl)ethylsulphonylprop-2-enoic acid ethyl ester sodium salt was prepared as follows:-

5 A solution of sodium ethoxide prepared from sodium (4.0 g) and ethanol (80 ml) was treated with propane-2-sulphonylacetonitrile (24.5 g) with stirring. After complete dissolution diethyl oxalate (24.8 g) was added dropwise over 10 minutes giving a heavy precipitate. After heating under reflux for 1 hour, the yellow solid
10 was filtered, washed with hexane, and dried in a vacuum dessicator (41.3 g). This was the title compound, m.p. 195-197.5°C.

EXAMPLE 29

Compounds Nos 59 and 52 and an Intermediate for No. 52

15 By proceeding in a similar manner to that described below but replacing 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methylthio-3-trifluoromethylpyrazole by the following phenylpyrazoles, there was obtained:-

20 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-ethoxycarbonyl-4-trifluoromethylsulphonylpyrazole as an off white solid, m.p. 210-214°C from 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-ethoxycarbonyl-4-trifluoromethylthiopyrazole.

25 5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-bromo-4-trifluoromethylsulphonylpyrazole in the form of an white solid, m.p. 179-180°C from 5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-bromo-4-trifluoromethylthiopyrazole.

5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-
3-cyano-4-trifluoromethylsulphinyipyrazole in the form
of white solid, m.p. 203-203.5°C from
5-amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-cyano-
5 4-trifluoromethylthiopyrazole.

A stirred solution of 5-amino-1-(2,6-dichloro-
4-trifluoromethylphenyl)-4-methylthio-3-trifluoromethyl-
pyrazole (1.0 g) in chloroform (40 ml) was treated with
10 m-chloroperbenzoic acid (0.42 g), portionwise at room
temperature. After stirring for 6 hours, the solution
was diluted with dichloromethane and washed in turn
with sodium sulphite solution, sodium hydroxide
solution, and water. The solution was dried over
15 anhydrous magnesium sulphate, and evaporated in vacuo
to give a yellow oil. Purification by chromatography
on silica (Merck, 230-400 mesh, 0.7 kg cm⁻²) eluting
with dichloromethane-ethylacetate (4:1) gave 5-amino-
1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methyl-
20 sulphiny-3-trifluoromethylpyrazole in the form of a
white solid, m.p. 142-145°C with decomposition.

REFERENCE EXAMPLE 10

5-Carbamoyl-4-cyano-1-(2,6-dichloro-
4-trifluoromethylphenyl)-3-trifluoromethylpyrazole
25 (3.57 g) was heated to 200°C with phosphorus pentoxide
(2.82 g) with stirring. After 3 hours, the cooled
product was treated with ice, and extracted with
dichloromethane (3 x 50 ml). The organic solution was
washed with water, dried over anhydrous magnesium

W
sulphate, and evaporated in vacuo to give a solid.
Recrystallisation from hexane gave 1-(2,6-dichloro-
4-trifluoromethylphenyl)-4,5-dicyano-3-trifluoromethyl-
pyrazole in the form of white crystals (1.8 g),
5 m.p. 80°C.

By proceeding in a similar manner to that described
above but replacing the
5-carbamoyl-4-cyano-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-3-trifluoromethylpyrazole by
10 5-amino-3-carbamoyl-1-(2,6-dichloro-4-trifluoromethyl-
phenyl)-4-methanesulphonylpyrazole there was prepared:-
5-Amino-3-cyano-1-(2,6-dichloro-4-trifluoro-
methylphenyl)-4-methanesulphonylpyrazole in the form of
a white solid, m.p. 214°C.

15

REFERENCE EXAMPLE 11

5-Carbamoyl-4-cyano-1-(2,6-dichloro-
4-trifluoromethylphenyl)-3-trifluoromethylpyrazole used
in the above Reference Example 10, was prepared as
follows:-

20

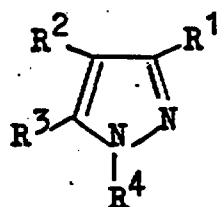
5-Carboxy-4-cyano-1-(2,6-dichloro-4-trifluoro-
methylphenyl)-3-trifluoromethylpyrazole (6.0 g) was
added to thionyl chloride (30 ml) and the stirred
solution heated to reflux for 4 hours. The solvent
was evaporated in vacuo, and re-evaporated after
25 addition of dry toluene (30 ml). The resultant orange
oil was dissolved in dry ether (10 ml) and added
dropwise to a stirred solution of ammonia (0.88, 20 ml)
cooled by an ice bath. After stirring overnight,
water (150 ml) was added, and the mixture extracted

with dichloromethane (3 x 50 ml). The combined extract was washed with water, dried over anhydrous magnesium sulphate, and evaporated in vacuo to give a white solid (7.0 g). Recrystallisation from a mixture of ethyl acetate and petroleum ether gave the title compound (4.3 g), in the form of white crystals, m.p. 180-181°C.

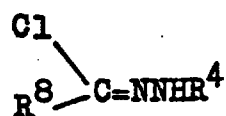
5-Amino-3-carbamoyl-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole used in the above Reference Example 10 was prepared by the same procedure, but by replacing the 5-carboxy-4-cyano-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-trifluoromethylpyrazole by 5-amino-3-carboxy-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole. The title compound was obtained in the form of an off-white solid, m.p. 223-224°C.

5-Amino-3-carboxy-1-(2,6-dichloro-4-trifluoromethylphenyl)-4-methanesulphonylpyrazole used above was prepared as follows:-

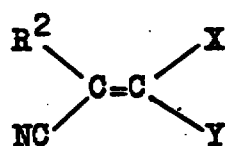
5-Amino-1-(2,6-dichloro-4-trifluoromethylphenyl)-3-ethoxycarbonyl-4-methanesulphonylpyrazole (8.15 g; Reference Example 3) was added to stirred 80% sulphuric acid (80 ml), and heated at 100°C for 5 hours. After cooling, the solution was poured onto ice, the solid filtered off and dried over phosphorus pentoxide in a vacuum desiccator. Recrystallisation from a mixture of methanol and petroleum ether gave the title compound as a white solid, m.p. 203-205°C.



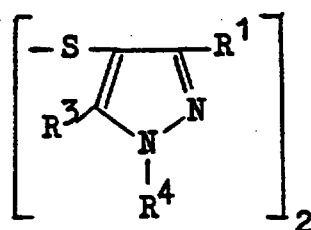
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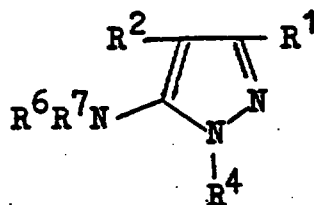
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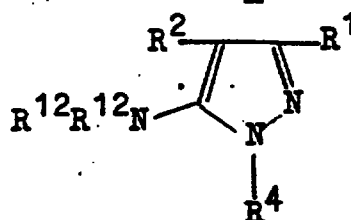
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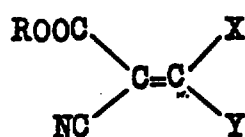
(VIII)



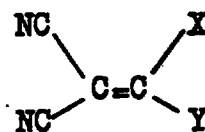
(IA)



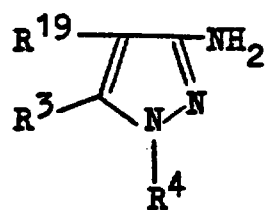
(IB)



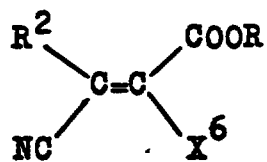
(XVIII)



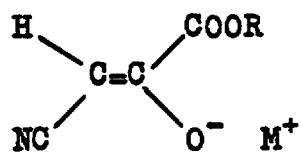
(XIX)



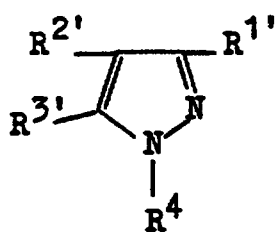
(XX)



(XXI)



(XXIV)

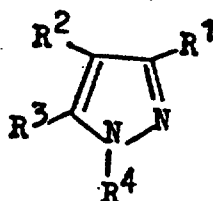


(XXV)



CLAIMS

1. An N-phenylpyrazole derivative of the general formula:



(I)

wherein R^1 represents a cyano or nitro group, a halogen atom, or an acetyl or formyl group;

R^2 represents a group R^5SO_2 , R^5SO , or R^5S in which R^5 represents a straight- or branched-chain alkyl, alkenyl or alkynyl group containing up to 4 carbon atoms which may be unsubstituted or substituted by one or more halogen atoms which may be the same or different;

R^3 represents a hydrogen atom or an amino group $-NR^6R^7$ wherein R^6 and R^7 , which may be the same or different, each represent a hydrogen atom or a straight- or branched-chain alkyl, alkenylalkyl or alkynylalkyl group containing up to 5 carbon atoms, a formyl group, a straight- or branched-chain alkanoyl group (which contains from 2 to 5 carbon atoms and which may be optionally substituted by one or more halogen atoms) or R^6 and R^7 together with the nitrogen atom to which they are attached form a 5 or 6 membered cyclic imide, or represents a straight- or branched-chain alkoxycarbonyl group (which contains from 2



to 5 carbons atoms and is unsubstituted or substituted by one or more halogen atoms), or R^3 represents a straight or branched-chain alkoxymethyleneamino group containing from 2 to 5 carbon atoms which may be unsubstituted or substituted on methylene by a straight or branched-chain alkyl group containing from 1 to 4 carbon atoms or represents a halogen atom; and R^4 represents a phenyl group substituted in the 2-position by a fluorine, chlorine, bromine or iodine atom; in the 4- position by a straight- or branched-chain alkyl or alkoxy group containing from 1 to 4 carbon atoms, which may be unsubstituted or substituted by one or more halogen atoms which may be the same or different, or a chlorine or bromine atom; and optionally in the 6-position by a fluorine, chlorine, bromine or iodine atom, with the exclusion of the compound wherein R^1 represents cyano, R^2 represents methanesulphonyl, R^3 represents amino and R^4 represents 2,6-dichloro-4-trifluoromethylphenyl.

2. A compound according to claim 1 wherein R^1 is other than a formyl group and neither R^6 nor R^7 represents an alkenylalkyl or alkynylalkyl group.

3. A compound according to claim 1 wherein R^2 represents an alkylsulphonyl/sulphinyl/thio group which is optionally halogen substituted and contains from 1 to 4 carbon atoms, or an alkenyl- or alkynyl-sulphonyl/-sulphinyl/thio group which is optionally halogen substituted and contains up to 4 carbon atoms, R^3 represents the hydrogen atom, an amino or methylamino group and R^1



represents a halogen atom or a cyano or nitro group.

4. A compound according to claim 3 wherein R^1 represents a cyano or nitro group.

5. A compound according to any one of the preceding claims wherein R^4 contains a trifluoromethyl or trifluoromethoxy group and R^2 represents an optionally halogenated alkylsulphonyl/sulphinyl/thio group containing from 1 to 4 carbon atoms.

6. A compound according to claim 5 wherein R^2 represents a trifluoromethylthio, trifluoromethylsulphinyl or trifluoromethylsulphonyl group.

7. A compound according to any one of the preceding claims wherein R^4 represents a 2,4,6-trichloro-, 2,6-dichloro-4-difluoromethoxy-, 2-chloro-4-trifluoromethyl-, 2-bromo-6-chloro-4-trifluoromethyl-, 2,6-dibromo-4-trifluoromethyl- or 2-bromo-4-trifluoromethyl-phenyl group.

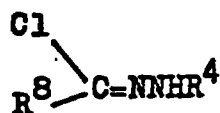
8. A compound according to any one of claims 1 to 6 wherein R^4 represents a 2,6-dichloro-4-trifluoromethyl- or 2,6-dichloro-4-trifluoromethoxy-phenyl group.

9. A compound according to claim 1 hereinbefore identified as any one of compounds 1 to 101.

10. A process for the preparation of a compound according to claim 1 which comprises:

(a) when R^2 represents an R^5SO_2 , R^5SO or R^5S group, R^3 represents the unsubstituted amino group and R^1 represents a cyano or acetyl group, the reaction of a compound of general

formula:



(II)

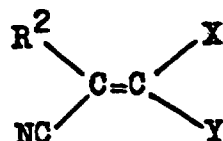
wherein R^8 represents a cyano or acetyl group and R^4 is as defined in claim 1, with a compound of the general formula $\text{R}^2\text{CH}_2\text{CN}$, wherein R^2 is as defined in claim 1;

(b) when R^2 represents an R^5S group and R^3 represents an amino group $-\text{NR}^6\text{R}^7$ wherein R^6 and R^7 each represents a hydrogen atom or a straight- or branched-chain alkyl, alkenylalkyl or alkynylalkyl group as defined in claim 1, the reaction of a compound corresponding to general formula (I) in which R^2 is replaced by the hydrogen atom with a compound of the general formula:-



wherein R^5 is as defined in claim 1;

(c) when R^1 represents a chlorine or fluorine atom, R^2 represents an R^5SO_2 , R^5SO or R^5S group, and R^3 represents an amino group, by the reaction of a compound of the general formula:



(IV)

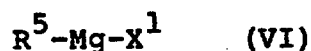


wherein X and Y both represent chlorine atoms or both represent fluorine atoms, with a phenylhydrazine of the general formula:



wherein R^4 is as defined in claim 1, or an acid addition salt thereof;

(d) (1) when R^2 represents an R^5S group, R^1 represents a chlorine, bromine, iodine or fluorine atom or a cyano or nitro group and R^3 represents an amino group, the reaction of a compound corresponding to general formula (I) in which R^2 is replaced by a thiocyanato group with a compound of the general formula:



(wherein R^5 is as defined in claim 1 and X^1 represents a halogen atom) or a compound of the general formula:

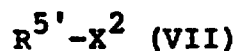


wherein $R^9-C\equiv C^-$ corresponds to R^5 in formula (I);

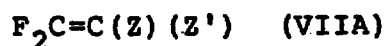
(d) (2) when R^2 represents an R^5S group wherein R^5S is other than a 1-alkenylthio or 1-alkynylthio group, the reaction of a compound corresponding to general formula (I) in which R^2 is replaced by a thiocyanato group with a base or a



reducing agent in the presence of a reagent of the general formula:

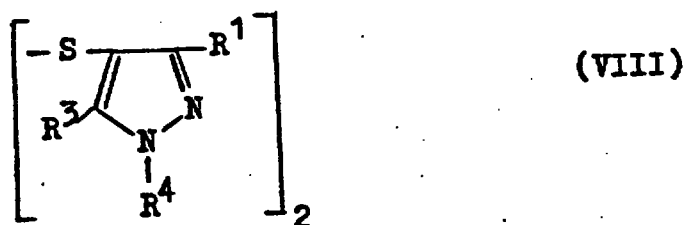


wherein $R^{5'}$ is as defined in claim 1 for R^5 with the exclusion of 1-alkenyl and 1-alkynyl and X^2 represents a halogen atom or with a base in the presence of a compound of the general formula:



wherein Z represents a fluorine, chlorine or bromine atom and Z' is as defined for Z or represents the trifluoromethyl group;

(d) (3) when R^5S is other than a 1-alkenylthio or 1-alkynylthio group, by the reductive alkylation of a disulphide of the general formula:



wherein R^1 , R^3 and R^4 are as defined in claim 1 employing a reducing agent in the presence of a base and of a halide of general formula (VII) wherein $R^{5'}$ is as hereinbefore defined;



- (e) when R^2 represents an R^5SO or R^5SO_2 group, by the oxidation of the sulphur atom in a compound of general formula I wherein R^2 represents a group R^5S ;
- (f) when R^1 represents a fluorine, chlorine, bromine or iodine atom or a cyano or nitro group, by the diazotisation of a compound corresponding to general formula (I) in which R^1 is replaced by an amino group and R^3 represents a hydrogen atom or an amino group, and conversion of the diazotised amino group R^1 by known methods into a fluorine, chlorine, bromine or iodine atom or a cyano or nitro group or when R^3 represents a halogen atom by the diazotisation of a compound of general formula (I) wherein R^3 represents an amino group and conversion of the diazotised amino group R^3 by known methods into a halogen atom;
- (g) when R^1 represents a fluorine atom or a cyano group and R^3 represents a hydrogen atom or the amino group, the reaction of a halide of general formula (I) wherein R^1 represents a chlorine or bromine atom with an alkali metal fluoride or with a metal cyanide to convert the chlorine or bromine atom to a fluorine atom or a cyano group;
- (h) when R^1 represents a nitro group and R^2 represents a group R^5SO_2 or R^5SO , by the reaction of a compound corresponding to general formula (I) in which R^1 is replaced by an unsubstituted amino group and R^2 is a group R^5SO_2 , R^5SO or R^5S , and R^3 represents a hydrogen atom or the amino group, with an oxidant to convert the unsubstituted amino group into a nitro group R^1 ;



- (i) when R^1 represents the cyano group and R^3 represents a hydrogen atom or the amino group, by the dehydration of a compound corresponding to general formula (I) in which R^1 is replaced by the carbamoyl group;
- (j) when R^1 is the acetyl group and R^3 represents a hydrogen atom or the amino group, by the reaction of a corresponding nitrile of formula (I) wherein R^1 is the cyano group, or of a corresponding ester wherein R^1 is replaced by an alkoxycarbonyl group CO_2R wherein R represents a straight- or branched-chain alkyl group containing from 1 to 6 carbon atoms, or of a carboxylic acid wherein R^1 is replaced by a carboxy group, with methyl lithium, or the reaction of a nitrile of formula (I) wherein R^1 is the cyano group or the ester wherein R^1 is replaced by an alkoxycarbonyl group CO_2R with a Grignard reagent CH_3MgX^3 wherein X^3 represents a halogen atom;
- (k) when R^1 represents the acetyl group and R^3 is as defined above, by the oxidation of an alcohol corresponding to general formula (I) wherein R^1 is replaced by a hydroxyethyl group, with an oxidant;
- (l) when R^1 represents a formyl group and R^3 is as defined above by the reaction of a corresponding nitrile of general formula (I) wherein R^1 represents a cyano group with a reducing agent followed by acid hydrolysis or with Raney nickel in formic acid to convert the cyano group to a formyl group;
- (m) the conversion by known methods of a compound of general formula (I) wherein R^3 represents an amino group NR^6R^7 into a compound of general formula (I) wherein R^3



represents a different amino group NR^6R^7 ;

(n) when R^3 represents a straight- or branched-chain alkoxymethyleneamino group containing from 2 to 5 carbon atoms which may be unsubstituted or substituted on methylene by a straight- or branched-chain alkyl group containing from 1 to 4 carbon atoms, by the reaction of a compound of general formula (I) wherein R^3 represents the unsubstituted amino group with a trisalkoxyalkane;

(o) when R^3 represents a group $-\text{NHCH}_2\text{R}^{16}$ wherein R^{16} represents the hydrogen atom or a straight- or branched-chain alkyl group containing from 1 to 4 carbon atoms, by the reaction of a compound of general formula (I) wherein R^3 represents a group $-\text{N}=\text{C}(\text{OR}^{17})\text{R}^{16}$ wherein R^{17} represents a straight- or branched-chain alkyl group containing from 1 to 4 carbon atoms with a reducing agent;

(p) when R^1 represents a formyl, acetyl, cyano or nitro group, and R^3 represents a fluorine atom, by a halogen exchange reaction with a compound of general formula (I) wherein R^3 represents a chlorine or bromine atom;

(q) when R^3 represents a hydrogen atom by the reaction of a compound of general formula (I) wherein R^3 represents an amino group with a diazotising agent in a solvent at ambient to reflux temperature to convert the amino group R^3 to a hydrogen atom;

(r) when R^1 represents a cyano or nitro group, R^2 is a group R^5SO_2 , R^6 and R^7 each represents a straight- or branched-chain alkyl, alkenylalkyl or alkynylalkyl group



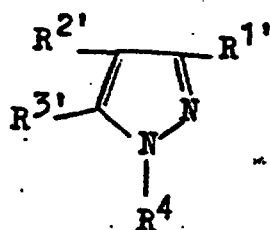
containing up to 5 carbon atoms and R^7 may also represent a hydrogen atom, by the reaction of a compound of general formula (I) wherein R^3 represents a halogen atom with the corresponding amine within general formula R^6R^7NH , or with dimethylhydrazine when R^6 and R^7 are both methyl; optionally followed by the conversion of a compound of general formula (I) thus obtained into another compound of general formula (I).

11. An arthropodicidal, plant nematocidal, anthelmintic or anti-protozoal composition which comprises a compound of general formula (I) in association with one or more compatible diluents or carriers.

12. A method for the control of arthropod, plant nematode, helminth or protozoal pests at a locus which comprises treatment of the locus with an effective amount of the compound according to claim 1.

13. A compound of general formula (I) as defined in claim 1 for use in the manufacture of a medicament for the treatment of an arthropod, helminth or protozoal infection.

14. A compound of the general formula:



(XXV)

wherein $R^{2'}$ is as defined in claim 1 for R^2 or represents the hydrogen atom, a thiocyanato, formyl, cyano or carboxy



group, a straight- or branched-chain alkoxycarbonyl group containing from 2 to 7 carbon atoms or the dithio group (which joins two pyrazole rings), $R^{3'}$ is as defined in claim 1 for R^3 or represents the diphenoxycarbonylamino group, and $R^{1'}$ is as defined in claim 1 for R^1 or represents the amino, 1-hydroxyethyl, carboxy or carbamoyl group or a straight- or branched-chain alkoxycarbonyl or alkoxycarbonylamino group containing from 2 to 7 carbon atoms,

with the exclusion of compounds of general formula (I) as defined in claim 1 and of those compounds of general formula (XXV) wherein R^4 represents 2,6-dichloro-4-trifluoromethylphenyl, $R^{2'}$ represents the cyano group, $R^{1'}$ represents the cyano group and $R^{3'}$ represents the amino, acetamido, dichloroacetamido, t-butylcarbonylamino, propionamido, pentanamido, bis(ethoxycarbonyl)amino, ethoxycarbonylamino, methylamino or ethylamino group,

or $R^{1'}$ represents the chlorine atom and $R^{3'}$ represents the amino, t-butylcarbonylamino, bis(ethoxycarbonyl)amino or ethoxycarbonylamino group,

or $R^{1'}$ represents a bromine or iodine atom or an amino or ethoxycarbonyl group and $R^{3'}$ represents the amino group,

or $R^{1'}$ represents the fluorine atom and $R^{3'}$ represents the hydrogen atom or the amino group,

or $R^{1'}$ represents a nitro, amino, t-butoxycarbonylamino or ethoxycarbonyl group and $R^{3'}$ represents the hydrogen atom;



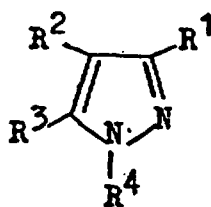
R^4 represents a 2,4,6-trichlorophenyl, 2-chloro-4-trifluoromethylphenyl or 2,6-dichloro-4-trifluoromethoxyphenyl group, $R^{2'}$ represents the cyano group, $R^{1'}$ represents the cyano group and $R^{3'}$ represents the amino group;

R^4 represents a 2,6-dichloro-4-trifluoromethoxyphenyl group, $R^{2'}$ represents the cyano group, $R^{1'}$ represents the chlorine atom and $R^{3'}$ represents the amino group; and R^4 represents the 2,6-dichloro-4-trifluoromethylphenyl group, $R^{2'}$ represents the methanesulphonyl group, $R^{1'}$ represents a carboxy, carbamoyl or ethoxycarbonyl group and $R^{3'}$ represents the amino group.

DERIVATIVES OF N-PHENYLPYRAZOLES

ABSTRACT

N-Phenylpyrazole derivatives of the formula:



(I)

wherein R^1 represents cyano, nitro, halogen, acetyl or formyl;

R^2 represents R^5SO_2 , R^5SO or R^5S in which R^5 is optionally halogen substituted alkyl, alkenyl or alkynyl;

R^3 represents a hydrogen atom or a group NR^6R^7 wherein R^6 and R^7 each represent hydrogen, alkyl, alkenylalkyl, alkynylalkyl, formyl, optionally halogen substituted alkanoyl, optionally halogen substituted alkoxy carbonyl, or alkoxy methyleneamino, halogen, or R^6 and R^7 together form a cyclic imide and R^4 represents a substituted phenyl group possess arthropodicial, plant nematocidal, anthelmintic and anti-protozoal properties; their preparation, compositions containing them and their use are described.