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Synthesis of New Substituted 1,3-Diphenyl-5-chloropyrazoles

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A number of new substituted 1,3-diphenyl-5-chloropyrazoles are prepared from 2-[(5-chloro-1,3-diphenyl-1*H*-pyrazol-4-yl)methylene]malononitrile (**2**).

In the last two decades we have developed several new syntheses of poly-functionally substituted aromatics and heteroaromatics utilizing activated nitriles as starting materials.[14–19] Thus, 5-chloro-1,3-diphenylpyrazole-4-carbaldehyde **1** condensed readily with malononitrile in ethanol to yield the corresponding ylidene **2** in excellent yield. Compound **2** reacted with 2-ethylidenemalononitrile **3a** in refluxing ethanol to yield the product of addition and hydrogen cyanide elimination. This was thus formulated as the pyrazole derivative **7a** and is assumed to be formed *via* the intermediacy of the Michael adduct **4** which readily cyclizes into **5** that loses HCN to yield **6**, which then tautomerizes into **7a**. The formation of **7a** in this reaction parallels the reported formation of 2-aminobenzene-1,3-dicarbonitriles from the reactions of ylidenemalonitriles with **3**.[23,24] In contrast to the behaviour of **2** towards **3a**, compound **3b** reacted with **2** to yield **7b**. Compound **7b** is assumed to be formed *via* the intermediacy of the Michael adduct **4** which readily cyclizes to **5**, which in turn tautomerizes into **7b** (Chart 1).

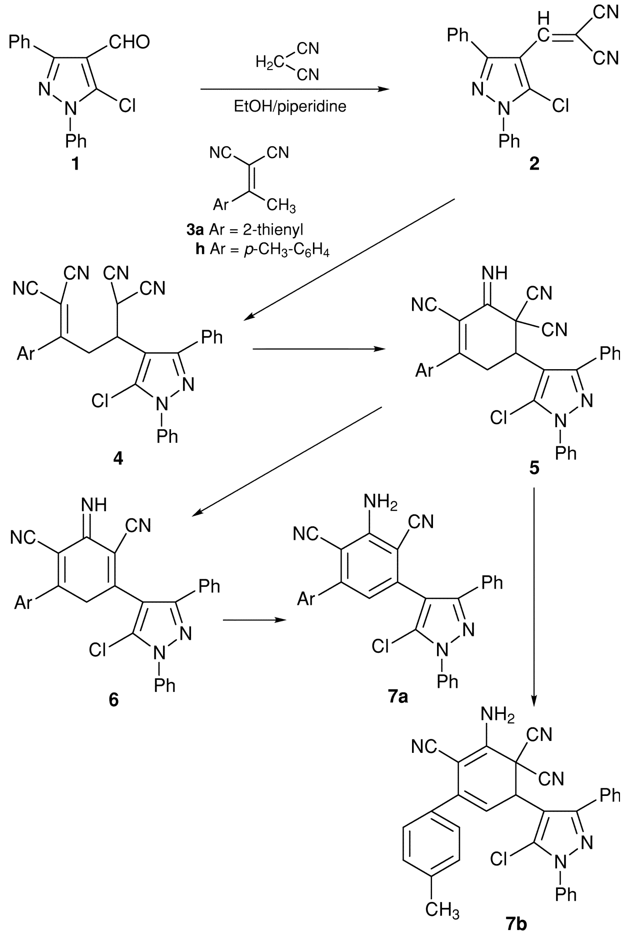

Chart 1

The reaction of 2-methyl-2-pyrazolin-5-one (**8a**) with **2** afforded the pyranopyrazole **9**. In contrast to the reported formation of pyranopyrazoles **10** upon treatment of arylidenemalononitrile **11** with substituted pyrazolones **8**, we found that **8b,c** reacted with **2** to yield **13a,b**. These are assumed to be formed *via* the intermediacy of the Michael adduct **12** which then eliminates malononitrile, yielding **13** (Chart 2).

Similar to the reported formation of phthalazines upon reacting **11** with ethyl 5-cyano-4-methyl-6-oxo-1-phenyl-1,6-dihydropyridazine-3-carboxylate (**14**), compound **14** reacted with **2** to yield the phthalazinone **18** which is assumed to be formed *via* the intermediates **15**–**17** (Chart 3).

It has been reported that 2-cyanomethyl-2-thiazolin-4-one **19a** and ethoxycarbonylmethyl-2-thiazolin-4-one **19b** react with **11** to yield **20** *via* addition of two molecules of **11** and elimination of one molecule of malononitrile. In contrast to this **19a,b** reacted with **2** to yield only a 1:1 adduct. This was formulated as **21** rather than **22** based on the IR spectrum. The formation of **21** from **2** and **19** is assumed to proceed *via* initial formation of the Michael adduct **23**.

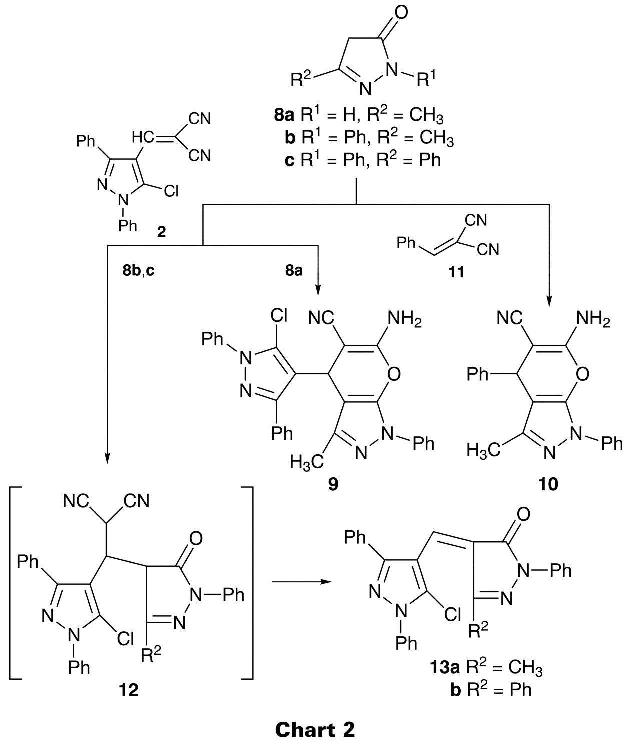

Chart 2

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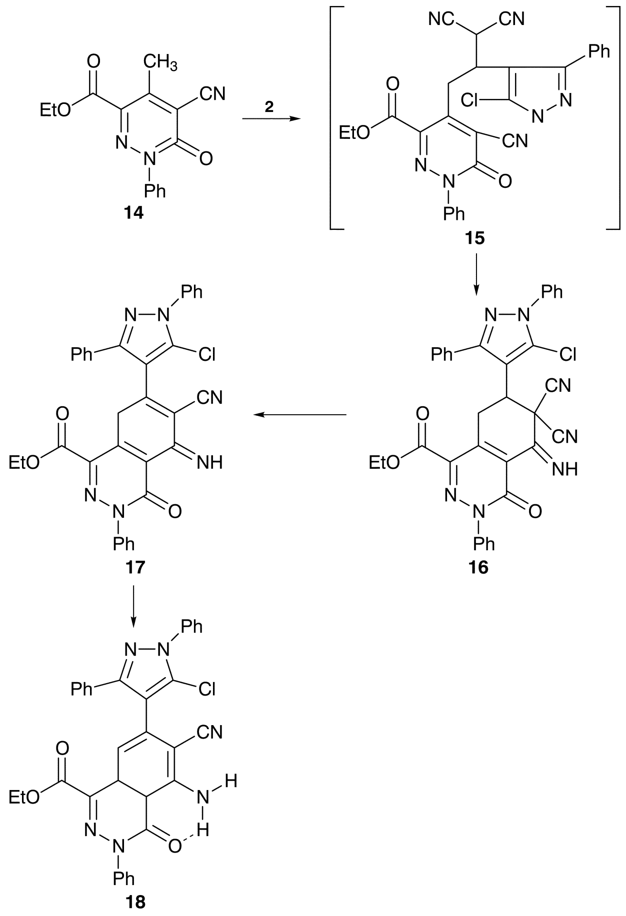

Chart 3

Similar to the behaviour of **19a**,**b**, compound **19c** also reacted with **2** to yield the adduct that is formulated as **21c** and not **22c** (Chart 4).

The structure of the product of reaction of **24a**–**c** with **11** is the subject of debate. Thus, some authors suggested[25,26] structure **25** while others,[27] believe that the formation of **26** occurs in this reaction. We have found that **24a**–**c** react with **2** to yield the products of addition and subsequent cyclization, as indicated from the mass spectra. Thus, we believe that this product is **27a**–**c** and is formed according to the sequence shown in Chart 4 (Chart 5).

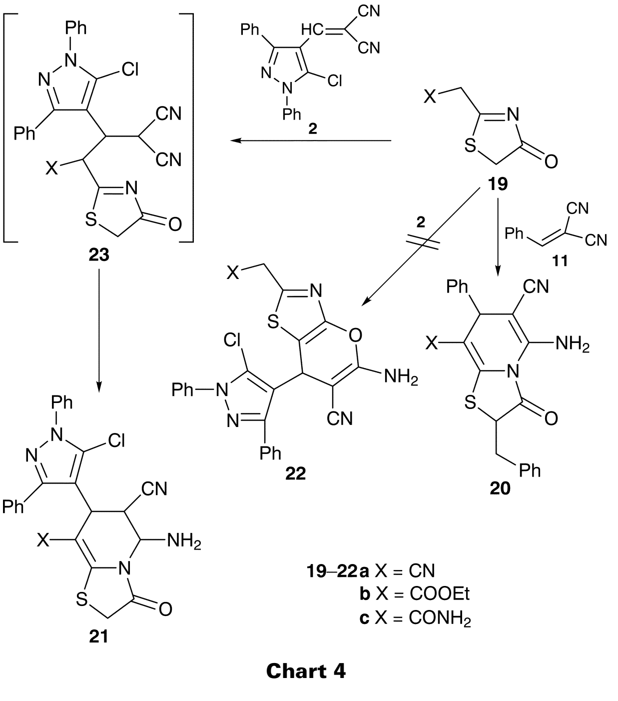

Chart 4

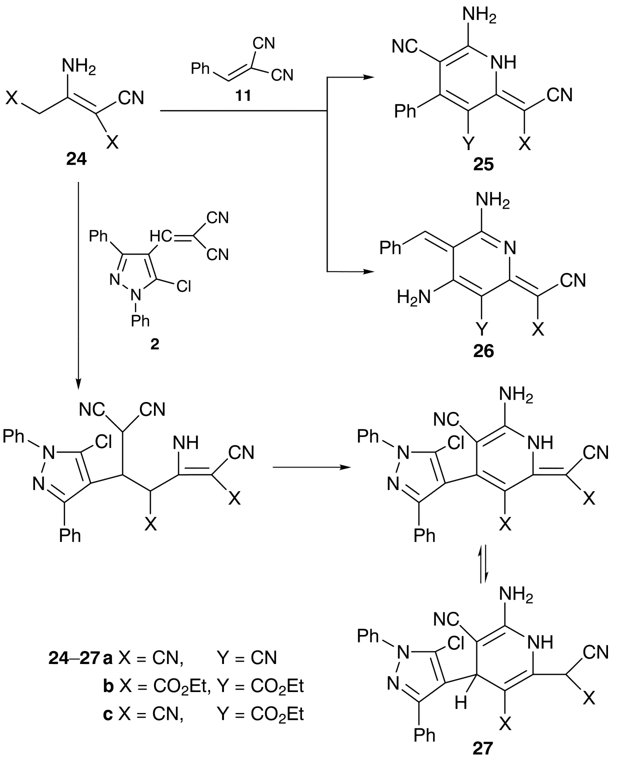

Chart 5

Techniques used: IR, ^{1}H NMR, mass spectrometry and elemental analysis

References: 27

Charts: 5

Table 1: Yields, mps, colour and elemental analysis for compounds **2**, **7a**,**b**, **9**, **13a**,**b**, **18**, **21a**–**c** and **27a**–**c**

Table 2: Spectral data for **2**, **7a**,**b**, **9**, **13a**,**b**, **18**, **21a**–**c** and **27a**–**c**

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References cited in this synopsis

14 M. H. Elnagdi and A. W. Erian, *Liebigs Ann. Chem.*, 1990, 1215.

15 N. S. Ibrahim, M. H. Mohamed, Y. Mahfouz and M. H. Elnagdi, *J. Prakt. Chem.*, 1989, **331**, 375.

16 M. H. Mohamed, N. S. Ibrahim, M. M. Hussien and M. H. Elnagdi, *Heterocycles*, 1988, **27**, 1301.

17 S. A. S. Ghozlan, F. A. E. Abdel-Aal, M. H. Mohamed and M. H. Elnagdi, *Z. Naturforsch., Teil B*, 1986, **41**, 489.

18 G. E. H. Elgomeie, H. A. Elfaham, S. Elgamal and M. H. Elnagdi, *Heterocycles*, 1985, **23**, 1999.

19 M. H. Elnagdi, A. H. H. Elghandour, M. K. A. Ibrahim and I. S. A. Hafiz, *Z. Naturforsch., Teil B*, 1992, **47**, 572.

23 N. S. Ibrahim, F. M. Abdel-Galil, R. M. Abdel-Motaleb and M. H. Elnagdi, *Bull. Chem. Soc. Jpn.*, 1987, **60**, 4486.

24 E. A. A. Hafez, Z. E. Kandeel and M. H. Elnagdi, *J. Heterocycl. Chem.*, 1987, **24**, 224.

25 S. M. Fahmy, N. M. Abed, R. M. Mohareb and M. H. Elnagdi, *Synthesis*, 1982, 490.

26 N. M. Abel, N. S. Ibrahim, S. M. Fahmy and M. H. Elnagdi, *Org. Prep. Proced. Int.*, 1985, **17**, 107.

27 K. U. Sadek, M. A. Selim, M. A. Elmaghraby and M. H. Elnagdi, *Die Pharm.*, 1993, **48**, 419.