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# Ring Transformation Reactions Part IV: 6-Aryl-3-methoxycarbonyl-4-methylthio-2H-pyran-2-one, A Novel Synthon for the Synthesis of 1,3-Terphenyls from Aryl Ketones[#]

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***Abstract:*** 4′-Methoxycarbonyl-5′-methylthio-1′,3′-terphenyls (**3**) and methyl (4,6-diarylpyran-2-ylidene)acetate (**4**) are synthesized from 6-aryl-3-methoxycarbonyl-4-methylthio-2H-pyran-2-ones (**1**). The salient feature of this procedure is to provide symmetrical, unsymmetrical and heteroaryl terphenyls in single step.

Suitably functionalized 1,3-terphenyls are useful precursors in the design and synthesis of host compounds, efficient for ion transport. The coplanarity of such aromatic nuclei and their attached functionalities provide in almost rigid conformation to the molecule which could be exploited for the synthesis of macrocycles.

This paper reports a novel strategy leading to easy access to the vicarious synthesis of functionalized symmetrical, unsymmetrical and heteroaryl 1,3-terphenyls in single step through ring transformation reactions. The earlier procedures for the synthesis of 1,3-terphenyls are largely based on the metal assisted[1], aryllithium[2] and arylboric acid[3] arylation of 1,3-dihalobenzene, while others involve[4] decomposition of 3-nitrosoacetamidobiphenyls or 1,3-bis[nitrosoacetamido]benzene and the action of arylmagnesium halides on 3-phenylcyclohexanone[5], 3-chlorophenyl alkyl sulphides[6] and 4,6-diarylpyran-2-ones[7] separately. The Diels-Alder reaction on the last with methyl propiolate[8] also led to the formation of title compound. A circuitous multistep synthesis of terphenyls with desired functionality has also been reported[9] in poor yield.

Our approach to synthesize 1,3-terphenyls is based on the carbanion induced ring transformation of the 6-aryl-3-methoxycarbonyl-4-methylthio-2H-pyran-2-ones. The lactones **1** have been found vulnerable to nucleophilic attack because of the presence of several electrophilic centers like its cyano analogue which provides single step syntheses of a variety of heterocycles such as pyrazoles[10], isoxazoles[11], 2-aminopyridines[12] and 2-iminopyridines[13] illustrating the tremendous synthetic potential of compounds of type **1**.

Reaction of **1** with a substituted acetophenone (**2**) in the presence of alkali in dry DMF yielded two products: the major one was characterized as 1,3-terphenyl (**3**) and the minor constituent as methyl (4,6-diarylpyran-2-ylidene)acetate (**4**) (Table 1).

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[#]CDRI Communication No. 5417

**Scheme 1**

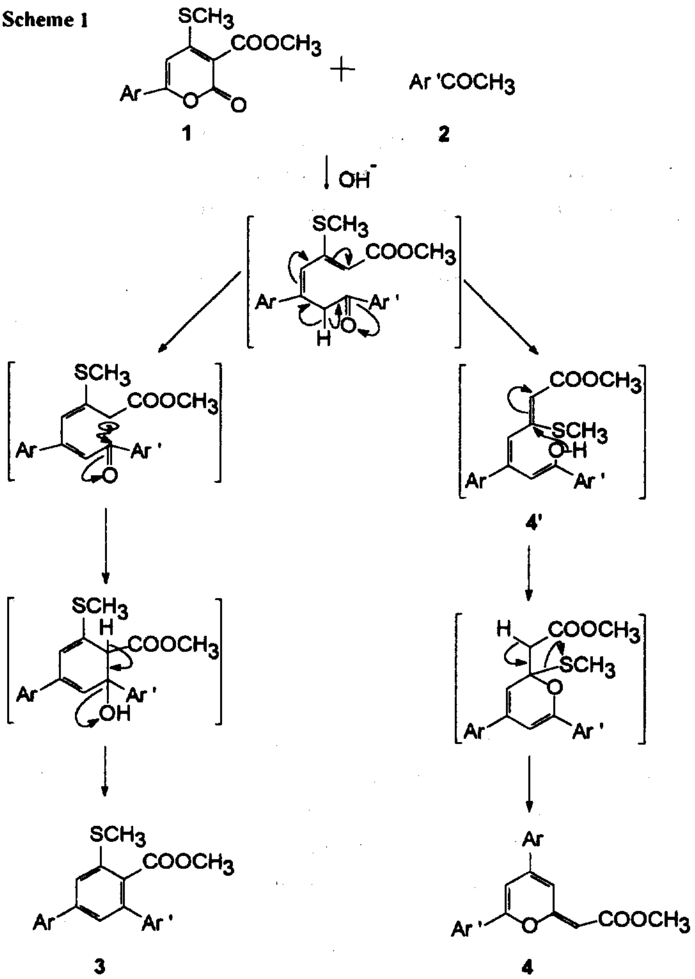

**Table 1**

| | Ar | Ar′ | Yield[a] (%) | |
|---|---|---|---|---|
| | | | 3 | 4 |
| a | $\text{4-ClC}_6\text{H}_4$ | $\text{4-ClC}_6\text{H}_4$ | 50.6 | 25.0 |
| b | $\text{4-FC}_6\text{H}_4$ | $\text{4-FC}_6\text{H}_4$ | 51.2 | 23.2 |
| c | $\text{4-BrC}_6\text{H}_4$ | $\text{4-BrC}_6\text{H}_4$ | 51.9 | 28.3 |
| d | $\text{4-ClC}_6\text{H}_4$ | $\text{3,4-Cl}_2\text{C}_6\text{H}_3$ | 50.4 | 26.2 |
| e | $\text{4-ClC}_6\text{H}_4$ | $\text{4-FC}_6\text{H}_4$ | 50.2 | 23.1 |
| f | $\text{4-ClC}_6\text{H}_4$ | $\text{4-BrC}_6\text{H}_4$ | 54.1 | 18.8 |
| g | $\text{4-ClC}_6\text{H}_4$ | $\text{4-NO}_2\text{C}_6\text{H}_4$ | 56.4 | 00.0 |
| h | $\text{4-ClC}_6\text{H}_4$ | $\text{3-NO}_2\text{C}_6\text{H}_4$ | 66.2 | 00.0 |
| i | $\text{4-FC}_6\text{H}_4$ | $\text{3,4-Cl}_2\text{C}_6\text{H}_3$ | 56.7 | 26.4 |
| j | 4-Pyridyl | 4-Pyridyl | 62.2 | 00.0 |

[a] All reactions were run in dry DMF at room temperature.

It is surprising to note that under similar reaction conditions the 6-aryl-3-cyano-4-methylthio-2H-pyran-2-ones yielded only a product analogous to **4** through enolised intermediate (4'). Reaction of **1** with highly electron deficient aryl or heteroaryl ketones led to the formation of **3** exclusively. In order to improve the yield of product **3**, different bases such as NaH, t-BuOK, NaOEt were used but none of them was found superior to KOH. All the synthesized compounds were characterized by elemental and spectroscopic analyses. The data for representative compounds are mentioned in reference section[14].

The reaction for the formation of **3** is possibly initiated by attack at C-6 in **1** by the carbanion generated in situ from acetophenones with ring opening, followed by decarboxylation and intramolecular cyclization while formation of **4** is based on intramolecular Michael addition of enolate (4') to olefinic bond with simultaneous elimination of methylmercaptan as depicted in Scheme 1.

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14. Spectral data:

    **3a:** mp: 155-157°C; $^1$H NMR(CDCl$_3$) δ : 2.56 (3H, s), 3.68 (3H, s), 7.32-7.56 (10H, m); $^{13}$C NMR(CDCl$_3$) δ : 17.48, 52.13, 125.52, 125.79, 128.46, 128.59, 129.12, 129.59, 132.70, 134.05, 134.41, 137.75, 138.16, 138.46, 140.14, 141.86, 168.36; IR(KBr): 1720 cm$^{-1}$ (CO); MS m/z: [M$^+$] 402(54), 400(72), 371(55), 369(100), 338(63); Anal. calcd. for $C_{21}H_{16}Cl_2O_2S$: C, 62.53; H, 3.99. Found C, 62.68; H, 4.02.

    **3b:** mp: 143-145°C; $^1$H NMR(CDCl$_3$) δ : 2.56 (3H, s), 3.66 (3H, s), 7.1-7.14 (4H, dd), 7.32 (1H, s), 7.38 (2H, d), 7.48 (1H, s), 7.56 (2H, d); IR(KBr): 1730 cm$^{-1}$ (CO); MS m/z: [M$^+$] 370(100), 369(83), 339(66); Anal. calcd. for $C_{21}H_{16}F_2O_2S$: C, 68.09; H, 4.35. Found: C, 68.12; H, 4.51.

    **4a:** oil; $^1$H NMR (CDCl$_3$) δ : 4.02 (3H, s), 6.56 (1H, s), 7.18 (1H, s), 7.28 (1H, s), 7.54-7.72 (8H, m); IR(KBr): 1660 cm$^{-1}$ (CO); MS m/z: [M$^+$] 372(13.8), 371(61), 369(100), 339(70.6), 314(56), 312(93); Anal. calcd. for $C_{20}H_{14}Cl_2O_3$: C, 64.35; H, 3.78. Found: C, 64.72; H, 3.89.

    **4b:** oil; $^1$H NMR (CDCl$_3$) δ : 4.04 (3H, s), 6.82 (1H, s), 7.22 (1H, s), 7.32 (1H, s), 7.4-7.48 (4H, dd), 7.68 (2H, d), 7.76 (2H, d); IR(KBr): 1660 cm$^{-1}$ (CO); MS m/z: [M$^+$] 340(26), 339(83), 292(17), 277(24.3); Anal. calcd. for $C_{20}H_{14}F_2O_3$: C, 70.58; H, 4.14. Found: C, 70.93; H, 4.45.

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