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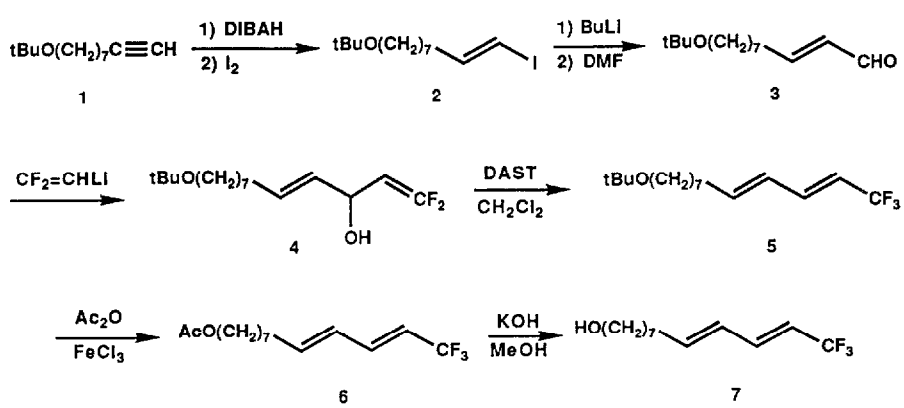
# Synthesis of a New Fluorinated Analog of (E,E)-8,10-Dodecadienol (Codlemone)

**Frédérique Tellier[1]* and Raymond Sauvêtre[2]**

1-INRA, Laboratoire des Médiateurs Chimiques,
Domaine de Brouessy, 78114 Magny-les-Hameaux (France)
2-Laboratoire de Chimie des Organoéléments, associé au CNRS,
Université P. et M. Curie, Tour 44, 4 place Jussieu, 75252 Paris Cedex 05 (France)

*Abstract: A stereospecific synthesis of trifluoromethylated codlemone is described. The key step is the treatment of 1,1-difluoro-1,4-dien-3-ol by DAST to give the corresponding (E,E)-1,1,1-trifluoro-2,4-dienic compound*

The codling moth, *Cydia pomonella* (Lepidoptera, Tortricidae) is a major world wide pest of apple orchards. The main component of the sex pheromone produced by the female has been identified as (E,E)-8,10-dodecadienol (codlemone)[1]. For the past few years, several laboratories have been interested in syntheses of fluorine-substituted pheromone components to study pheromonal receptors[2]. Fluorine atoms can replaced hydrogen atoms without notable steric consequences but this replacement leads to major changes in hydrophobicity and polarity of the hydrocarbon chain[3]. In a previous publication, we have described the preparation of several fluorocodlemones with fluorine-substituted at vinylic carbons which have been tested in fields and have shown interesting properties[4]. We have recently reported an efficient method for the incorporation of allylic trifluoromethyl group[5], herein we described an extension of our work with the synthesis of a fluorinated analog of codlemone namely 12,12,12-trifluoro-8,10-dodecadienol. Our procedure was based on two key steps. A first reaction between difluorovinyllithium, prepared *in situ* with difluoroethylene and s-BuLi, and adequate aldehyde led to 1,1-difluoro-1,4-dien-3-ol[6]. Secondly, the intermediate alcohol was attacked by DAST (diethylaminosulfur trifluoride) according to a $SN2'$ substitution reaction of the hydroxy moiety by fluoride to afford the desired trifluorinated compound.




1 2 3 4 5 6 7

The pure (E)-alkenyliodide **2** was obtained by hydroalumination of the t-butoxyalkyne **1** followed by iodolysis[4,7] (70% yield). **2** was successively treated with n-BuLi[8] and DMF to afford the aldehyde **3** (bp. 105-110°C/0.05 Torr, 93% yield). The treatment of **3** with 2,2-difluorovinyllithium, quantitatively prepared *in situ* from 1,1-difluoroethylene and s-Buli (THF/$Et_2O$=80/20, -100°C)[6], led to the dienol **4**. The latter was relatively unstable and should be used fastly. To the intermediate dienol **4** (1eq.) was added DAST (1eq.) ($CH_2Cl_2$, -70°C to 0°C) to afford the trifluorinated diene **5** (bp. 78-80°C/0.01 Torr, 56% yield from aldehyde **3**, isomeric purity≥99%). The t-butyl ether **5** was easily cleaved into the corresponding acetate **6** with $Ac_2O$ and $FeCl_3$ in $Et_2O$ without isomerisation (99% crude yield). The saponification of **6** with KOH led to the alcohol **7** (bp. 72°C/0.01 Torr, 95% yield) without any loss of steric purity and with 99% of chemical purity. All the mentioned products were characterized by spectral properties (IR, NMR)[9]. Their stereoisomeric and chemical purities were evaluated by gas chromatographic analyses[10].

In conclusion, this route allowed us to prepare products of very high stereoisomeric and chemical purities, in an excellent overall yield and in few steps. Moreover, we have shown that this procedure could be used for the synthesis of functionalized products like analogs of pheromones. This fluorinated codlemone is now available for laboratory and field bioassays on codling moths.

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**References and notes**

**1.** Roelofs, W.L.; Comeau, A.; Hill, A.; Milcevic, G. *Science* **1971**, *174*, 297.

**2.** i) Prestwich, G.D. *Pestic. Sci.* **1986**, *37*, 430 ; ii) Camps, F.; Coll, J.; Fabrias, G.; Guerrero, A. *Tetrahedron*, **1984**, *40*, 2871 ; iii) Briggs, G.G.; Cayley, G.R.; Dawson, G.W.; Griffiths, D.C.; Macauley, E.D.M.; Pickett, J.A.; Pile, M.M.; Wadhams, L.J.; Woodcock, C.M. *Pestic. Sci.* **1986**, *17*, 441.

**3.** i) Filler,R.; Kobayashi, Y. *Biomedicinal Aspects of Fluorine Chemistry, Elsevier, Amsterdam* **1982**, 246. ii) Prestwich, G.D.; Sun, W.C.; Mayer, M.S.; Dickens, J.C. *J. Chem. Ecol.* **1990**, *16*, 1761.

**4.** Tellier, F.; Sauvêtre, R. *J. Organomet. Chem.* **1989**, *364*, 17.

**5.** Tellier, F.; Sauvêtre, R. *Tetrahedron Lett.* **1991**, *32*, 5963.

**6.** Sauvêtre, R.; Normant, J.F. *Tetrahedron Lett.* **1981**, *22*, 957.

**7.** Zweifel, G.; Whitney, C.C. *J. Am. Chem.Soc.* **1967**, *89*, 2753.

**8.** Cahiez, G.; Bernard, D.; Normant, J.F. *Synthesis* **1976**, 245.

**9.** Infrared spectra were measured on a Perkin-Elmer 397 spectrometer (neat,$cm^{-1}$). $^1H$ and $^{13}C$ NMR spectra were recorded on a Jeol GSX 400 spectrometer ($CDCl_3$;δ(ppm) from TMS, J(Hz)) and $^{19}F$ NMR spectra on a Jeol FX 90 spectrometer ($CDCl_3$;δ(ppm) from $CFCl_3$, J(Hz)).

**IR : 5**: 2920, 1660, 1630, 1460, 1385, 1365, 1335, 1300, 1270, 1190, 1100, 985, 855, 720, 675; **6**: 2920, 1730, 1650, 1355, 1300, 1270, 1235, 1100, 990, 855, 675; **7**: 3320, 2920, 2840, 1660, 1620, 1460, 1330, 1300, 1270, 1185, 1100, 990, 860, 720, 675.

**NMR $^{19}F$ : 5**: -63.9 (d) J=6.9 ; **6**: -63.8 (d) J=6.9 ; 7: -63.8 (d) J=6.9.

**NMR $^1H$ : 5**: 1.2 (s,9H), 1.25-1.55 (m,10H), 2.14 (q,2H) J=6.5, 3.33 (t,2H) J=6.8; **6**:1.25-1.7 (m,10H), 2.0 (s,3H), 2.15 (q,2H) J=6.4, 4.05 (t,2H) J=6.8; **7**: 1.2-1.6 (m,10H), 2.14 (q,2H) J=6.3, 2.63 (s,1H), 3.60 (t,2H) J=6.7; **5,6,7**: (data of the double bond system are the same) 5.5 (dq,$H^2$), 6.0 (dt,$H^5$), 6.08 (dd,$H^4$), 6.71 (ddq,$H^3$); $JH^2/H^3$=15, $JH^3/F$=2.0, $JH^2/F$=6.9, $JH^3/H^4$=9.4, $JH^4/H^5$=15, $JH^5/H^6$=6.0.

**NMR $^{13}C$ : 5**: 26.5, 27.7, 29.0, 29.4, 29.6, 31.0, 33.0, 61.7, 72.5, 116.6 (q,$C^2$) J=33.6, 123.9 (q,$C^1$) J=268.55, 127.2 (s,$C^5$) , 138.0 (q,$C^3$) J=6.7, 143.1 (s,$C^4$); **6**: 21.1, 26.0, 28.8, 29.0, 29.2, 29.25, 32.9, 64.9, 116.9 (q,$C^2$) J=33.6, 124.3 (q,$C^1$) J=269.7, 127.7 (s,$C^5$), 138.6 (q,$C^3$) J=7.0, 143.8 (s,$C^4$), 172.1; **7**: 25.9, 28.9, 29.4, 29.5, 32.9, 33.0, 63.1, 116.9 (q,$C^2$) J=33.6, 124.4 (q,$C^1$) J=269.8, 127.7 (s,$C^5$), 138.6, (q,$C^3$) J=6.9, 143.9 (s,$C^4$).

**10.** Gas chromatographic analyses were performed on a model 2900 Carlo Erba instrument equipped with fused silica capillary polar column (25 m WCOT FFAP·0.32 id, $H_2$ carrier gas flow 25 ml/min, 1.2b).

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