Tetrahedron xxx (2016) 1–8

Contents lists available at ScienceDirect

Tetrahedron

journal homepage: www.elsevier.com/locate/tet

Synthesis of polyfunctionalized benzophenones via the reaction of 3-formylchromones with tertiary push–pull enamines

Alexey Yu. Barkov, Vladislav Yu. Korotaev, Igor B. Kutyashev, Vyacheslav Ya. Sosnovskikh *

Department of Chemistry, Institute of Natural Sciences, Ural Federal University, 620000 Ekaterinburg, Russian Federation

ARTICLE INFO

Article history:
Received 20 December 2015
Received in revised form 15 February 2016
Accepted 1 March 2016
Available online xxx

Keywords:
3-Formylchromones
Enaminones
Benzophenones

ABSTRACT

Uncatalyzed nucleophilic reaction of 3-formylchromones with tertiary push–pull enamines in refluxing acetonitrile gave polyfunctionalized benzophenone derivatives as a result of a [3+3] annulation in moderate to good yields.

1. Introduction

3-Formylchromones, oxygen-containing heterocycles related to 1,3-dicarbonyl compounds, are highly reactive organic molecules, which have been extensively studied in recent years.[1] As masked tricarbonyls, 3-formylchromones possess unique chemical reactivity in both nucleophilic and cycloaddition reactions due to the presence of three electrophilic centers in their molecules (the C-2 and C-4 atoms of the chromone system and the 3-formyl group). Owing to their availability and high reactivity, as well as to the fact that many chromone derivatives are widely distributed in the plant kingdom and have proven to be promising medicines,[2] interest in these compounds as starting substrates for production of more complex biologically active molecules is quite natural.

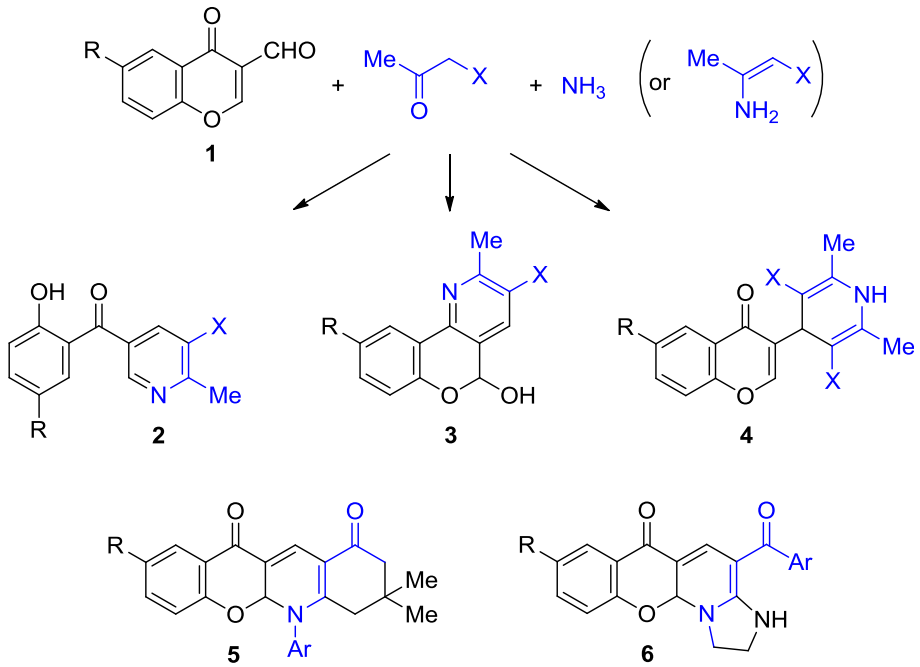
Most pertinent to the present research are the reactions involving the additions of 1,3-C,N- and 1,3-C,C-dinucleophiles to 3-formylchromones, which occur at the C-2 atom and carbonyl groups and give various carbo- and heterocyclic compounds. While the reactions of 3-formylchromones with such 1,3-C,N-dinucleophiles as primary push–pull enamines have been studied in sufficient detail,[3] very little information is available on their reactions with secondary enaminones.[4] Thus, 3-formylchromones **1** react with acetylacetone in the presence of ammonia to give pyridines **2**, the formation of which involves Knoevenagel condensation and the subsequent reaction of the condensate with ammonia.[3a] In contrast, ethyl acetoacetate and ammonia under similar conditions, and acetylacetone pretreated with ammonia react with 3-formylchromones **1** giving the chromeno[4,3-*b*]pyridines **3**.[3a] With alkyl β-aminocrotonates, chromones **1** formed only Hantzsch-type dihydropyridines **4**.[3a–c] A three-component reaction involving chromones **1**, aromatic amines and dimedone gave chromeno[2,3-*b*]quinolines **5**;[4a] with cyclic ketene aminals, which can be regarded as secondary push–pull enamines, similar tetracyclic compounds **6** were obtained[4b] (Scheme 1).

Notably, tertiary push–pull enamines derived from 1,3-dicarbonyl compounds and secondary amines have not received any attention at all in the reactions with 3-acylchromones despite their potential interest as 1,3-C,C-dinucleophiles[5] in organic synthesis for the construction of substituted benzophenones, which show a variety of useful pharmacological and physical properties.[6] In this context, the regioselective approaches that build up the aromatic moiety starting from readily available precursors are of considerable current interest since a short synthesis of highly substituted compounds has many obvious advantages.

We herein report the formation of functionalized aminobenzophenones from 3-formylchromones **1**, which serve as 1,3-C,C-dielectrophilic units, and tertiary enaminones, derived from acetylacetone, benzoylacetone and acetoacetic ester. These push–pull enamines behave as 1,3-C,C-dinucleophiles due to the presence of a vinylogous methyl group (Fig. 1).

* Corresponding author. E-mail address: vy.sosnovskikh@urfu.ru (V.Ya. Sosnovskikh).

http://dx.doi.org/10.1016/j.tet.2016.03.005
0040-4020/



Scheme 1. Known products from 3-formylchromones **1** and primary and secondary enaminones.

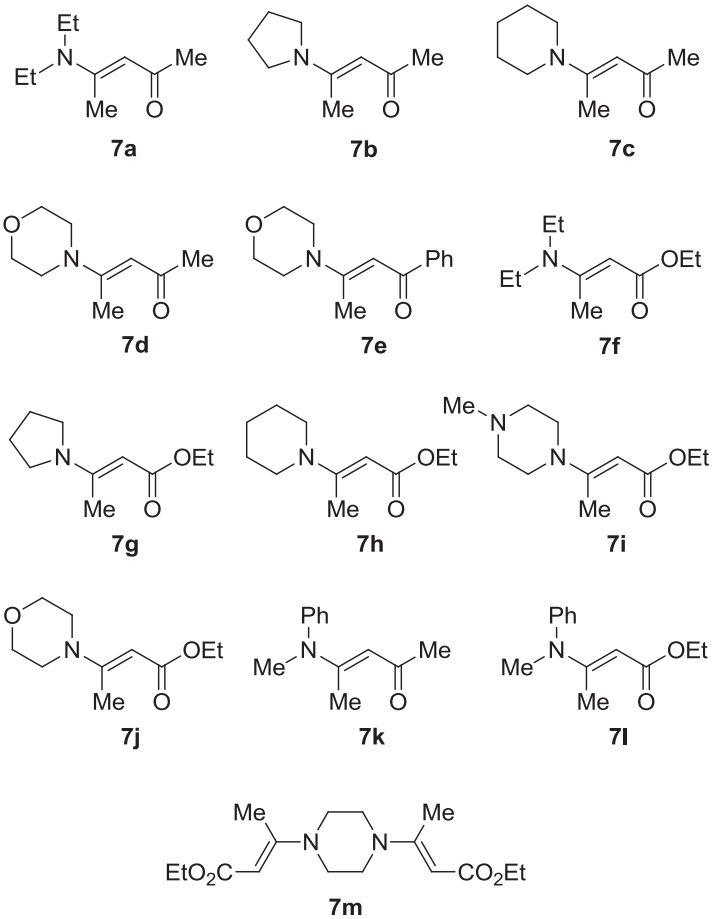


Fig. 1. Structures of the used tertiary enaminones **7a**–**m**.

Please cite this article in press as: Barkov, A. Y.; et al., Tetrahedron (2016), http://dx.doi.org/10.1016/j.tet.2016.03.005