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REVISED STRUCTURES OF THE AZAFLUORENONE ALKALOIDS FROM *GUATTERIA DIELSIANA**

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Key Word Index—*Gutteria dielsiana*; Annonaceae; structural revision; synthesis; onychine; 6-methoxyonychine; dielsine; dielsinol.

Abstract—The structures of three alkaloids isolated from *Gutteria dielsiana*, 6-methoxyonychine, dielsine and dielsinol, originally described as 1-azafluoren-9-ones, are revised to 4-azafluoren-9-ones on the basis of previous synthetic work and current studies on alkaloids of the Annonaceae. Synthetic 6-methoxyonychine (6-methoxy-1-methyl-4-azafluoren-9-one) is shown to be identical with the natural product.

INTRODUCTION

The highly conjugated, yellow alkaloid onychine (1) was first isolated in 1976 from *Onychopetalum amazonicum*, when its structure was misassigned as 4-methyl-1-azafluoren-9-one [1]. 1-Methyl-4-azafluoren-9-one had been synthesized previously [2], was prepared again by another route a year later [3], and in 1979 was synthesized once more and shown to agree with onychine in its spectral properties and those of its borohydride reduction product, while the 4-methyl-1-aza isomer was proved to be different [4]. In spite of these results, the erroneous formula was retained several years later when this substance was reisolated from *Cleistopholis patens* [5] and *Gutteria dielsiana* [6], and was invoked as the framework upon which the structures of several novel, more oxygenated azafluorenones from the latter plant were based [6]. More recently, four other related alkaloids have been isolated from *Meiogyne virgata* [7] and *Oxandra cf. major* [8], and thorough NMR studies of these compounds leave no doubt that they are 1-methyl-4-azafluoren-9-one derivatives. A biogenetic scheme has also been suggested which, among other things, points to a possible route for the formation of 4-azafluoren-9-ones, but not the 1-aza isomers [7].

RESULTS AND DISCUSSION

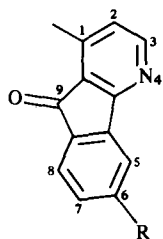
In this context it becomes necessary to revise the structures of the *Gutteria dielsiana* azafluorenone derivatives: 6-methoxyonychine (2), dielsine (3) and dielsinol (4) [6]. All three are now depicted as sharing the 1-methyl-4-azafluorene skeleton, in line with the correct structures of onychine and of its more recently discovered analogues. In support of this revision, the *O*-croyloximes (mixture of geometric isomers) of 6-methoxyindanone were heated under air at 180° to give a complex mixture of products from which 6-methoxy-1-methyl-4-azafluoren-9-one was isolated chromatographically. This approach is unambiguous as regards the position of the substituent on the benzene ring [4]. Comparison of synthetic 6-methoxy-1-methyl-4-azafluoren-9-one (2) with 6-methoxyonychine from *Gutteria dielsiana* showed them to be identical in all respects.

EXPERIMENTAL

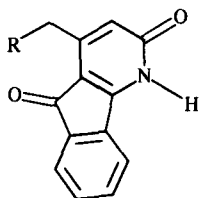
Synthesis of 6-methoxy-1-methyl-4-azafluoren-9-one (2). A mixture of 6-methoxyindanone [9] (1.8 g), *O*-croylhydroxylamine [10] (1.6 g), NaOAc (0.60 g), Na₂CO₃ (1.0 g) and EtOH (15 ml) was refluxed for 2 hr. The solvent was removed and the residue was extracted with CH₂Cl₂ to afford a mixture of (*E*)- and (*Z*)-oximes (2.8 g). The oximes (1.0 g) were heated under air at 170–180° for 20 hr, the reaction products were taken up in CH₂Cl₂, the basic constituents extracted with 4% HCl, the aq. soln made alkaline with NH₃ and extracted with CH₂Cl₂, giving a mixture of 1- and 3-methyl-4-azafluorenones and traces of 4-azafluoren-9-ones (0.12 g). This was fractionated by 'flash' chromatography and TLC on silica gel, eluting with CH₂Cl₂-MeOH (99:1), to yield 6-methoxy-1-methyl-4-azafluoren-9-one as a yellow gum (5 mg): EIMS *m/z* (rel. int.) 225.0795 [*M*⁺] (100),

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- 1 R = H
2 R = OMe



- 3 R = H
4 R = OH

(4.26), 276 sh (4.09), 283 (4.11), 294 (4.09), 308 sh (3.74), 328 (3.36), 343 (3.36).

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C₁₄H₁₁NO₂ calc. 225.0790, 224 [M⁺ - H] (10.8), 210 [M⁺ - CH₃] (9.6), 197 [M⁺ - CO] (1.4), 196 [M⁺ - H - CO] (11.4), 195 [M⁺ - CH₂O] (13.6), 182 (7.6), 167 (6.2), 154 (7.3), 127 (8.8), 86 (12.5), 84 (22.5), 49 (32.9); ¹H NMR (500 MHz, CDCl₃) δ 2.63 (s, 3H, C-1-CH₃), 3.94 (s, 3H, OCH₃), 6.87 (dd, J_o = 8.2 Hz, J_m = 2.3 Hz, 1H, H-7), 6.96 (d, J = 5.3 Hz, 1H, H-2), 7.35 (d, J_m = 2.3 Hz, 1H, H-5), 7.64 (d, J_o = 8.2 Hz, 1H, H-8), 8.39 (d, J = 5.3 Hz, 1H, H-3); IR ν_{max} cm⁻¹: 1700, 1610, 1595 sh, 1570, 1555 sh, 1468, 1433, 1425 sh, 1386, 1357, 1272 sh, 1260, 1245 sh, 1213, 1180, 1097, 1085 sh, 1048, 1010, 928, 892, 872, 830, 792, 767; UV λ_{max}^{EtOH} nm (log ε): 214 (4.09), 225 (4.36), 235 (4.36), 245 (4.36), 276 sh (4.36), 280 (4.21), 292 (4.36), 326 (3.44), 340 (3.44); λ_{max}^{EtOH+HCl} nm (log ε) 216 (4.05), 230 sh (4.09), 240 sh (4.21), 248