2-Phenyl-4-quinolinone Alkaloids from *Casimiroa edulis* Llave et Lex (Rutaceae)

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**Summary.** Three new 4-quinolinone alkaloids (5,6-dimethoxy-2-(3-methoxyphenyl)-1H-quinolin-4-one, 5,6-dimethoxy-2-(3,4-dimethoxyphenyl)-1H-quinolin-4-one, 5,6-dimethoxy-2-(2,5,6-trimethoxyphenyl)-1H-quinolin-4-one) were isolated from the leaves of *Casimiroa edulis* Llave et Lex (Rutaceae) cultivated in Egypt. Their structures were determined by UV/Vis, IR, $^1$H and $^{13}$C NMR, and EI mass spectroscopy. The alkaloids were also detected in the kernels of the seeds.

**Keywords.** Quinolinone alkaloids; Natural products; Spectroscopy.

**Introduction**

*Casimiroa edulis* Llave et Lex (Rutaceae) is a tree distributed in the temperate zones of Mexico and central America (popularly called *Zapote blanco*, or white sapote). It is known for its interesting sedative-like effect and as sleep inducer [1–3]. The tree is cultivated in Egypt for its edible fruits. In folk medicine, a decoction of the leaves and, less frequently, of the seeds is administered [4]. The aqueous extract of the leaves has shown anticonvulsant and sedative activities [5]. Also, the leaf is most frequently used to treat ailments related to hypertension [4]. The seed, root, and bark of *C. edulis* have extensively been worked up to yield histamine derivatives, such as N$^\alpha$, N$^\alpha$-dimethylhistamine [6], casmidine, and casimiroedlin [7–9], compounds of marked hypotensive activity. Zapotidine alkaloid [10], yet another hypotensive constituent, has been isolated from the seeds. Furoquinoline alkaloids together with 2-quinolones and 4-quinolones, such as edulein, edulin, eduline, casmiroin, and others constitute the major part of the total bases [11, 12]. Coumarins, flavonoids, and limonoids have been also reported as constituents [13]. Only two reports about the constituents of the leaves were found [4, 14]. Imidazole alkaloid derivatives have also been isolated from leaves of *C. edulis* [4]. In addition, isopimpinellin, casmiroin, skimianine, 1-methyl-2-phenyl-4-quinolone, edulein, and scopoletin methyl ether have been isolated from the leaves [14]. Thus, the leaves were thought to be in need of further investigations, aiming to the isolation of new compounds from the plant.

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Results and Discussion

All isolated compounds 1–3 have a yellow fluorescence in UV light and give an orange colour on TLC plates when sprayed with Dragendorff’s reagent. They give a positive test for the presence of nitrogen [15].

![Chemical structure](image)

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The presence of the γ-pyridone moiety and, therefore, the 4-quinolinone structure of 1–3 was indicated by their IR ($\nu_{\text{max}}$ (KBr) = 3450–3500 (NH), 1650 (C=O), and 1590 (aryl NH) cm$^{-1}$ [16, 17]) and UV/Vis ($\lambda_{\text{max}} = 250–270$ and 302–332 nm [18]) spectra as well as by the signal of the carbonyl group at 180–182 ppm in their $^{13}$C NMR spectra.

The three compounds have related $^1$H NMR spectra. The number of protons and the deshielded methoxy groups suggested that all compounds contain the phenyl quinolinone structure. Because of lack of literature on the suggested alkaloid structure, interpretation of the obtained data was carried out in the light of available data on this type of alkaloids (some of them isolated from the same plant) as well as of methoxyflavones (especially those isolated from the same plant). The $^1$H NMR spectra of 1–3 indicated 5,6-dimethoxy substitution of ring A by the presence of two doublets with an ortho-coupling constant of 9.2 Hz at $\delta =$ 7.37–7.49 and 7.47–7.56 ppm (H-7 and H-8; cf. 5,6-dimethoxyflavones [19, 20]). Also, all show the presence of a sharp singlet in the range of 6.20–6.74 ppm, which could be assigned to a proton in position 3. This evidence was supported by the mass fragmentation pattern.

**Compound 1**

The $^1$H NMR spectrum of 1 indicated monosubstitution in ring B. This was postulated from a complex absorption pattern in the aromatic region, a multiplet at $\delta =$ 7.13 ppm, integrating for one proton assignable to H-4$'$ and a multiplet at $\delta =$ 7.44–7.57 ppm integrating for three protons at C-2$'$, C-5$'$, and C-6$'$. The presence of one methoxy group in ring B was confirmed from the mass spectrum of the compound which showed a fragment at $m/z = 132$. The protons of the B-ring moiety could be clearly assigned by comparison with those of...