

SOME C-SECOCULARINES FROM *CERATOCAPNOS PALAESTINUS*WIMAL H.M.W. HERATH,<sup>1</sup> MUSA H. ABU ZARGA,<sup>2</sup> SALIM S. SABRI,<sup>2</sup>  
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ABSTRACT.—*Ceratocapnos palaestinus* of Jordanian origin has yielded the new C-secocularines ceratonicine [2], ceratocapnine [3], and ceratocapnidine [4]. 2-Methyl-7-methoxy-8-hydroxytetrahydroisoquinoline [5] which has been previously prepared by synthesis was also present in the plant.

Two types of secocularines are known. The lactamic C-secocularines are probably the result of the *in vivo* oxidation of cularines at the C-1 to C- $\alpha$  bond, whereas the basic B-secocularines are produced through Hofmann  $\beta$  elimination of cularine *N*-metho salts and incorporate a dimethylaminoethyl side chain.

The botanical genus *Ceratocapnos* consists of only two species, and belongs to the Fumariaceae (1). *Ceratocapnos palaestinus* Boiss. has not been previously investigated. This plant was collected near Irbid, in northern Jordan, and was found to be a source of several new C-secocularines, which were accompanied in the plant by no less than 27 known alkaloids, 14 of which belong to the cularine grouping. Prior to this report, only one C-secocularine had been identified, namely noyaine [1], which was found in *Corydalis claviculata* (2).

Ceratonicine [2], C<sub>21</sub>H<sub>21</sub>NO<sub>7</sub>, the first new C-secocularine, showed  $\lambda$  max (MeOH) 220, 255, 313 nm (log  $\epsilon$  4.49, 4.03, 3.95). This spectral pattern is close to that observed for noyaine [1] (2). The ir spectrum exhibited  $\nu$  max (CHCl<sub>3</sub>) 1715 (conjugated ester) and 1645 and 1620 cm<sup>-1</sup> (conjugated lac-

ram). In the mass spectrum, the molecular ion *m/z* 399 was also the base peak.

The <sup>1</sup>H-nmr spectrum was close to that reported for noyaine, particularly in the aromatic region. The *N*-methyl lactam singlet appeared at  $\delta$  3.07, whereas the *O*-methyl singlet was at  $\delta$  3.71. The methylenedioxy protons resonated as a singlet at  $\delta$  5.89. A special feature of this spectrum was the triplet-quartet system centered at  $\delta$  1.34 and 4.31, diagnostic of an ethyl ester.

Ceratocapnine [3], C<sub>22</sub>H<sub>25</sub>NO<sub>7</sub>, the second new alkaloid,  $\nu$  max (CHCl<sub>3</sub>) 1712, 1640, and 1620 cm<sup>-1</sup>, presented a uv spectral pattern slightly different from that of 2, with  $\lambda$  max (MeOH) 218, 253, 302 nm (log  $\epsilon$  4.48, 4.03, 3.56). The maximum at 302 nm should be compared with that at 313 nm in the case of species 2. The difference is due to an alternate substitution pattern in the bottom ring.

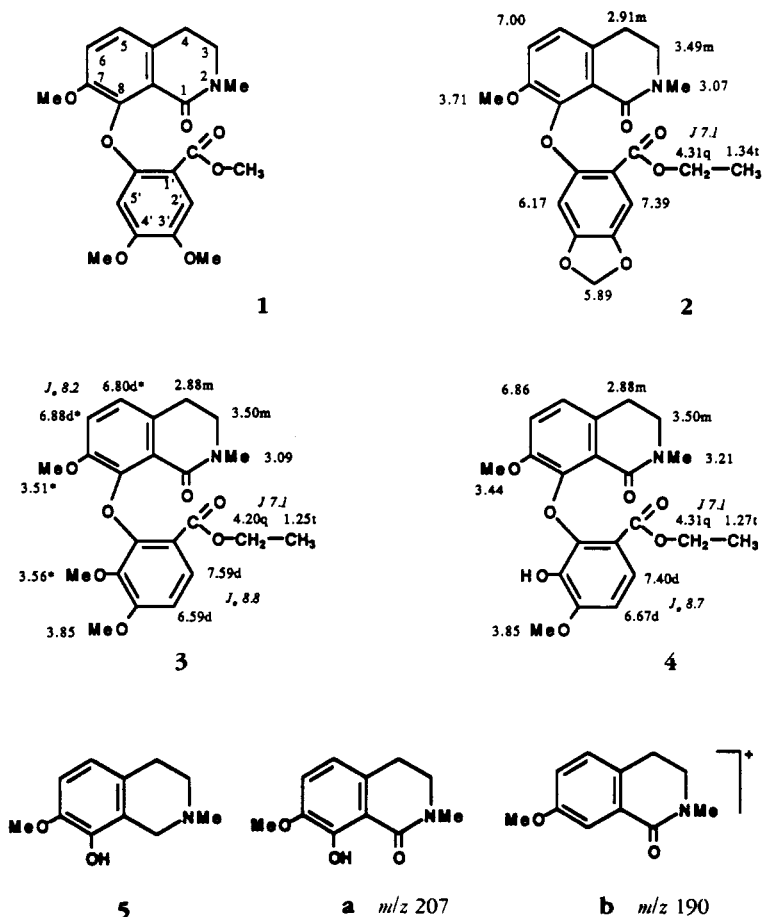
The substitution pattern in that ring was clearly indicated by the nmr spectrum, which exhibited an aromatic AB system at  $\delta$  6.59 and 7.59 (*J* = 8.8 Hz). Three methoxyl singlets were present at  $\delta$  3.51, 3.56, and 3.85, the first two of which could be assigned to the substituents at C-7 and C-5'. Again, as in the spectrum of ceratonicine [2], an *N*-methyl singlet at  $\delta$  3.09 underlined the presence of a lactam *N*-methyl, while the triplet-quartet pattern at  $\delta$  1.25 and 4.20 testified to the presence of an ester function.

The third C-secocularine, the monophenolic ceratocapnidine [4],

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\*Chemical shifts with identical superscripts are interchangeable.

$C_{21}H_{23}NO_7$ ,  $\nu$  max 1710, 1680, 1620  $cm^{-1}$ , possessed a uv spectrum quite similar to that of ceratocarpine [3],  $\lambda$  max (MeOH) 219, 256, 301 nm ( $\log \epsilon$  4.77, 4.25, 3.85), denoting a related substitution pattern. However, a small bathochromic shift in base indicated the presence of a phenolic function.

The nmr spectrum included a singlet at  $\delta$  3.21 belonging to the *N*-methyl lactam. Besides the downfield *O*-methyl singlet at 3.85, a three-proton absorption upfield at  $\delta$  3.44 suggested the presence of a methoxyl at either C-7 or C-5'. This question was resolved by the mass spectrum, which indicated that the second methoxyl was at C-7 since fragmentation resulting in the formation of species **a** and **b** was clearly in evidence.

The above three compounds are most likely the result of biogenetic oxidation of the known cularines *O*-methylcularicine, sarcocarpine, and sarcocapnidine (3), the last two of which were actually found to be present in the plant. It should also be pointed out that because ethyl esters are rare in nature, the three new seco compounds may actually exist in the plant as methyl esters. Ester exchange could then have occurred during the isolation-purification process.

Other known alkaloids also found in *C. palaestinus* are the cularinoids (+)-culararine, (+)-3'-*O*-demethylculararine, (+)-celtine, (+)-cularimine, (+)-cularicine, (+)-norcularicine, (+)-cularidine, (+)-claviculine, (+)-sarcocarpine, (+)-sarcocapnidine, oxocularine, oxosarcocapni-

dine, and oxocompostelline; the aporphines (+)-glaucine, (+)-norglaucine, (+)-isoboldine, and (+)-thaliporphine; the benzylisoquinolines (+)-reticuline, (-)-*N*-methylcoclaurine, and juziphine; the morphinandienones (+)-*O*-methylpallidine, (-)-isosalutaridine, and (-)-sinoacutine; the phthalideisoquinoline (+)-bicuculline; and the benzophenanthridine (+)-chelidonine. These compounds were identified either by comparison with authentic samples, or through their spectral characteristics.

The last alkaloid characterized, 2-methyl-7-methoxy-8-hydroxytetrahydroisoquinoline [**5**], has been known previously as a synthetic product (4). This represents its first isolation from a natural source.

## EXPERIMENTAL

**PLANT COLLECTION AND EXTRACTION AND ALKALOID ISOLATION.**—The whole plant (5.5 kg, dry wt) was collected near Irbid in March 1985. The plant was identified by Prof. D. El-Isawi, and a voucher specimen was deposited in the Herbarium of the University of Jordan. The powdered material was extracted with EtOH at room temperature. A crude extract was obtained following filtration and solvent evaporation. This was extracted with 5% HCl. The aqueous acid extract was basified with NH<sub>4</sub>OH and extracted with CHCl<sub>3</sub> to afford 13 g of crude alkaloids.

Chromatography was carried out on a column of Si gel (60–230 mesh, 1500 g). Elution was

with CHCl<sub>3</sub> containing increasing amounts of MeOH. Final purification was on Si gel tlc glass plates. All known alkaloids were obtained in relatively small amounts of 15 mg or less. Nmr spectra are in CDCl<sub>3</sub> at either 200 or 360 MHz.

**CERATONICINE** [**2**].—7 mg; amorphous; ms *m/z* [M]<sup>+</sup> 399 (100), 353 (2), 352 (4), 326 (11), 324 (10), 297 (27), 283 (21), 207 (58), 193 (22), 190 (53).

**CERATOCAPNINE** [**3**].—2 mg; amorphous; ms *m/z* [M]<sup>+</sup> 415 (100), 400 (16), 385 (7), 384 (28), 342 (20), 313 (24), 207 (33), 190 (30).

**CERATOCAPNIDINE** [**4**].—6 mg; amorphous; ms *m/z* 401 (96), 371 (8), 370 (29), 324 (64), 299 (34), 298 (100), 297 (41), 269 (61), 207 (16), 190 (15).

**2-METHYL-7-METHOXY-8-HYDROXY-1,2,3,4-TETRAHYDROISOQUINOLINE** [**5**].—5 mg; amorphous (4).

## ACKNOWLEDGMENTS

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