Communications to the Editor

Isolation of Alkaloids from Rauwolfia Spp.

Isolation of Sarpagine, Yohimbine, and δ-Yohimbine from the Roots of *Rauwolfia heterophylla* Roem et Schult

Four alkaloids, reserpine,[1] *l*-narcotine,[1] ajmaline,[2] and serpentine[2,3] have so far been isolated from the roots of *Rauwolfia heterophylla*. We have now isolated three more alkaloids, with reserpine and ajmaline, from the weakly basic alkaloidal fraction, obtained from the roots of *Rauwolfia heterophylla*,* by chromatography with aluminum oxide and fractional crystallization.

One of the three alkaloids, which was obtained from the chloroform-insoluble portion of the weakly basic alkaloidal fraction, crystallized from ethanol in fine needles, was found to be identical with sarpagine[4] (raupine[5]), which was originally found in the root of *Rauwolfia serpentina*, m.p. >300°, $[\alpha]_D^{21}$: +53° (pyridine). *Anal.* Calcd. for $C_{19}H_{22}O_2N_2$: C, 73.52; H, 7.15; N. 9.03. Found: C. 73.88; H, 7.00; N, 9.53. This alkaloid reduced the Fehling and ammoniacal silver nitrate solution and produced bright violet in the Keller reaction and a brownish violet color with conc. nitric acid. Ultraviolet absorption: λ_{max}^{EtOH} 228 mμ (log ε 4.30), 280 mμ (log ε 3.85); λ_{min}^{EtOH} 251 mμ (log ε 3.35). The identity of this alkaloid with sarpagine was established by direct comparison with the material isolated from *R. serpentina*.

The second alkaloid, which was obtained with reserpine and ajmaline from the chloroform-soluble portion of the weakly basic alkaloidal fraction, crystallized from acetone in needles, and was found to be identical with yohimbine, which had already been isolated from the root of *R. serpentina*[6,7] and *R. canescens*[8], m.p. 230~233°, $[\alpha]_D^{21}$: +105° (pyridine). *Anal.* Calcd. for $C_{21}H_{26}O_3N_2$: C, 71.16; H, 7.39; N, 7.90. Found: C, 71.02; H, 7.20; N, 8.03. λ_{max}^{EtOH} 226 mμ (log ε 4.50), 282 (3.98), 290 (3.80), λ_{min}^{EtOH} 248 mμ (log ε 3.25). The hydrochloride, crystallized from methanol, melted at 298~300°. *Anal.* Calcd. for $C_{21}H_{26}O_3N_2 \cdot HCl$: C, 64.52; H, 6.96; N, 7.17. Found: C, 64.21; H, 6.69; N, 7.22. The hydrochloride as well as the free base showed no depression on admixture with an authentic specimen.

The third alkaloid was obtained from the methanolic mother liquor of reserpine by chromatography with aluminum oxide. It crystallized from chloroform-methanol in prisms, m.p. 253~255°, and was found to be identical with δ-yohimbine, which had been found in the root of *R. serpentina* by several investigators almost simultaneously.[7~11] *Anal.* Calcd. for $C_{21}H_{24}O_3N_2$: C, 71.57; H, 6.87; N, 7.95. Found: C, 71.68;

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H, 6.84; N, 8.17. The hydrochloride, crystallized from methanol, had m.p. 285~288°. A mixture of authentic δ-yohimbine and our free base showed no depression of the melting point. The ultraviolet spectrum of the free base in ethanol revealed maxima at 226 mμ(log ε 4.65) and 282 mμ(log ε 3.93) and minimum at 265 mμ(log ε 3.83).

Isolation of Reserpine, Ajmaline, and Sarpagine from the Roots of *Rauwolfia indecora* R. E. Woodson

Our investigations on the alkaloids of *Rauwolfia indecora* have led to the isolation of reserpine, ajmaline, and sarpagine.

The weakly basic alkaloidal fraction, obtained from the roots of *Rauwolfia indecora*,* was separated with chloroform into the chloroform-soluble and -insoluble portions.[4] Chromatography of the chloroform-soluble portion with aluminum oxide yielded two crystalline alkaloids. The earlier eluted one was shown to be identical with reserpine, which was originally found in the root of *Rauwolfia serpentina*[12] and later in *R. heterophylla*,[1] *R. canescens*,[13] and *R. vomitoria*,[14] m.p. 260~263°, $[\alpha]_D^{21}$: −117°($CHCl_3$), *Anal.* Calcd. for $C_{33}H_{40}O_9N_2$: C, 65.11; H, 6.62; N, 4.60. Found: C, 65.14; H, 6.77; N, 4.82. λ_{max}^{EtOH} 217 mμ(log ε 4.73), 268(4.23), 296(4.03); λ_{min}^{EtOH} 246 mμ(log ε 3.95), 288(4.02). This alkaloid showed no depression on admixture with an authentic specimen isolated from *R. serpentina*.**

The second alkaloid proved to be ajmaline which was originally found in *R. serpentina*[15] and then in *R. heterophylla*.[2] It crystallized from methanol in colorless rods, m.p. 157~160°(previous swelling), undepressed on admixture with the material isolated from *R. heterophylla* by the writers. $[\alpha]_D^{21}$: +140°($CHCl_3$). *Anal.* Calcd. for $C_{20}H_{26}O_2N_2 \cdot CH_3OH$: C, 70.36; H, 8.44; N, 7.82. Found: C, 70.10; H, 8.35; N, 7.96. λ_{max}^{EtOH} 248 mμ(log ε 3.95), 292(3.44); λ_{min}^{EtOH} 227 mμ(log ε 3.48), 272(3.02).

The third alkaloid, which was obtained from the chloroform-insoluble portion of the weakly basic alkaloidal fraction, crystallized from acetone in long peaked plates with m.p. >320°. The identity of this alkaloid with sarpagine[4](raupine[5]), which was originally found in *R. serpentina* and most recently in *R. heterophylla* by the writers, was established by direct comparison with an authentic specimen.

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