m/e 313 (M^+, base), 298, 285 and 270. High resolution MS, M^+, calcd. 313.1313, found 313.1295.

N-*Methylation of norpallidine.* A soln of 2 mg of **6** in 2 ml 85% HCOOH and 1 ml 40% HCHO was heated on a steam-bath for 10 hr. Solvent was evaporated under *vacuo*, the residue diluted with 10 ml H_2O, basified with 1N NaOH to pH 8, and thoroughly extracted with $CHCl_3$. TLC gave a major spot which was collected and shown to be spectrally identical with an authentic sample of pallidine (**7**).

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APORPHINE AND TETRAHYDROBENZYLISOQUINOLINE ALKALOIDS IN *SASSAFRAS ALBIDUM*§

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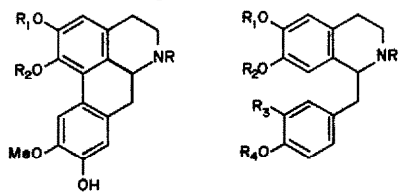
Several volatile compounds [1–4] namely safrole, eugenol, α-pinene, camphor, α-phellandrene, β-phellandrene, coniferaldehyde, piperonylacrolein have been identified in the root of *Sassafras albidum*. Besides these, sesamin and desmethoxyaschantin, the two lignans, sitosterol and 2,3-dihydroxy-1-[3,4-methylenedioxy phenyl]-propane have also been isolated from the root [2]. Recently we have identified eleven more volatile compounds in the petroleum ether extract [5]. We now report on the alkaloids of the root bark.‡

The alkaloidal fraction, separated by treatment with 5% aqueous HCl, showed the presence of at least six Dragendroff positive compounds by TLC. The six alkaloids were separated by preparative TLC. The compounds (A–C) showed UV spectra characteristic of 1,2,9,10-tetraoxygenated aporphine alkaloids [6,7]. The IR spectra showed bands for OH/NH function and aromatic system. The mass spectral fragmentation patterns and the relative intensities of the peaks especially those of M^+ and the base peaks $(M-1)^+$ were in agreement with the presence of 1,2,9,10-tetraoxygenated aporphine nucleus [8] in these compounds. The relative intensities of M^+ and $(M-31)^+$ peaks in the mass spectra, suggested [9] that only compounds A and B have a methoxyl group at position 1 of the aporphine nucleus whereas compound C does not. The presence of intense $(M-43)^+$ peaks in compounds A and C and a $(M-29)^+$ peak in compound B indicated [9] that A and C are N-Me aporphines while B is a N-unsubstituted (NH) aporphine. From spectral properties and other available data A and C were identified as boldine (**1**) [11], and isoboldine (**3**) [11] respectively. The identities were confirmed by direct comparison with authentic samples. Compound B was identified as norboldine (**2**) [11], this was confirmed by conversion to the corresponding N–Me derivative and comparison to a pure specimen of boldine (**1**).

The UV spectra of compounds (D–F) suggested that they were 1-benzyl 1,2,3,4-tetrahydroisoquinoline alkaloids. The mass spectra of the compounds which showed



	R	R_1	R_2
(1) Boldine;	Me	H	Me
(2) Norboldine;	H	H	Me
(3) Isoboldine;	Me	Me	H

	R	R_1	R_2	R_3	R_4
(4) Norcinnamolaurine;	H	$-CH_2-$		H	H
(5) Cinnamolaurine;	Me	$-CH_2-$		H	H
(6) Reticuline;	Me	Me	H	OH	Me

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‡ While this work was in progress presence of unidentified alkaloids has been suggested [10].

§ Part 6 in the series "Potential Carcinogens".

molecular ion peaks of very low intensity but intense peaks due to the loss of benzyl substituents, were in conformity with the 1-benzyl 1,2,3,4-tetrahydroisoquinoline skeleton [11]. Compounds (D, E, F) were characterized as norcinnamolaurine (**4**) [12] cinnamolaurine (**5**) [12] and reticuline (**6**) [13], respectively from their physical constants and spectral data and by direct comparison with authentic samples.

It is noteworthy that the commonly used beverages tea, coffee, cola and cocoa contain the purine bases such as caffeine, theobromine and theophylline, while sassafras, the roots of which are used for making 'tea', contain aporphine and tetrahydrobenzylisoquinoline bases. These types of alkaloid are known to occur in plants of the Lauraceae [14]. Safrole, the major constituent of sassafras is a hepatocarcinogen [15–18]. It will be of interest to explore the carcinogenic potential of the alkaloids herein reported.

EXPERIMENTAL

All mp's are uncorrected. UV and IR spectra were determined in EtOH and nujol, respectively. Si gel-G plates (0.25 mm) were used for TLC and a 6 ft glass column containing 3% OV-17 on Gas- Chrom Q was used for GC.

Isolation of bases. The air dried root bark material (500 g) (supplied by I. D. Auld Jr., 667 Ferry Street, Mt. Pleasant, South Carolina.) was extracted with petrol (bp 38–46°) and CH_2Cl_2, redried (430 g) and extracted with EtOH. Removal of EtOH gave a brown residue (48 g) which was treated with 5% aq HCl. After filtration the soln was first extracted with $CHCl_3$, basified with NH_4OH and re-extracted with $CHCl_3$. Solid residue (120 mg) from the $CHCl_3$ extract showed 5 Dragendroff positive spots on TLC (R_f 0.32, 0.55, 0.61, 0.65 and 0.71) in Me_2CO–MeOH (3:2). The alkaloidal mixture was separated on a preparative scale. The separated bands (I–V) were scraped off and extracted with $CHCl_3$–MeOH (7:3) to recover the alkaloidal material.

Compound A. Band V (R_f 0.71) yielded crystals (10 mg) mp 160–61°, λ_{max} 220, 283 and 304 nm, ν_{max} 3400 (OH), 1603, 1585 cm^{-1} (aromatic). MS ions at *m/e* 327 (M^+), 326 (base peak), 312, 310, 296, 284 and 269. Compound A was identified as boldine (**1**) by direct comparison with an authentic sample (mmp, UV, IR, TLC, GC, MS).

Compound B. Band I (R_f 0.32) furnished amorphous solid (25 mg) which was crystallized as hydrochloride mp 210–13°, λ_{max} 220, 283, 307 nm, ν_{max} 3300 (OH/NH), 1600 cm^{-1} (aromatic). Mass spectrum *m/e* 313 (M^+), 312 (base peak), 298, 284, 282 and 269. Compound B was characterized as norboldine (**2**) by conversion to boldine (**1**) by *N*-methylation.

N-Methylation of compound B. To compound B (9 mg) in MeOH (2 ml) was added (0.1 ml) HCHO followed by (15 mg) $NaBH_4$. The mixture was stirred for 30 min and dil with (10 ml) H_2O. CO_2 was passed through the mixture and the pH adjusted to 8. The mixture was extracted with $CHCl_3$ (3 × 5 ml). The $CHCl_3$ extract was dried and the solvent evaporated. Residue was crystallized from C_6H_6 to furnish colorless crystals (8 mg), mp 161–63°. The *N*-methyl derivative was found to be identical with a pure specimen of boldine (**1**) (mmp, IR, TLC, GC, MS).

Compounds C and D. Band III (R_f 0.61) afforded a colorless solid (8 mg). The solid on TLC in $CHCl_3$–MeOH (17:3) showed the presence of two compounds R_f 0.64 and 0.51 which were separated as two bands (III A and III B) by PLC. The band III A (R_f 0.64) yielded compound C (2 mg), mp 121–23°, MS ions at *m/e* 327 (M^+), 326 (base peak), 312, 296, 284 and 269. Compound C was identified as isoboldine (**3**) by a direct comparison (mmp, TLC, GC, MS) with an authentic sample. Band III B (R_f 0.51) furnished Compound D as crystals (4 mg), mp 196–97°, λ_{max} 287 nm. MS: *m/e* 283 (M^+), 176 (base peak), and 107. Direct comparison of Compound D with an authentic sample of norcinnamolaurine (**4**) by (mmp, TLC, GC, IR and MS) showed that the two compounds were identical.

Compound E. Band IV (R_f 0.65) furnished colorless crystals (6 mg), mp 207–8°, λ_{max} 287 nm, MS ions at *m/e* 297 (M^+), 190 (base peak) and 107. The Compound E was found to be identical with cinnamolaurine (**5**) by a direct comparison (mmp, IR, TLC, GC, MS) with an authentic sample.

Compound F. Band II (R_f 0.55) afforded light yellow amorphous solid (20 mg), λ_{max} 285 nm. The compound was crystallized as its perchlorate, mp 200–202°. Mass spectrum: *m/e* 329 (M^+), 192 (base peak), 137 and 107. The perchlorate was found to be identical with an authentic sample of reticuline perchlorate (mmp, TLC, GC, MS).

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