Phytochemical Investigation of *Convolvulus arvensis* (Convolvulaceae)

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Abstract □ A phytochemical investigation of the aerial parts of *Convolvulus arvensis* resulted in the isolation and identification of several *n*-alkanes and *n*-alkanols, α-amyrin, campesterol, stigmasterol, and β-sitosterol.

Keyphrases □ *Convolvulus arvensis* L.—phytochemical investigation of aerial parts, isolation and identification of *n*-alkanes, *n*-alkanols, α-amyrin, campesterol, stigmasterol, and β-sitosterol □ Medicinal plants—phytochemical investigation of *Convolvulus arvensis* □ European bindweed—phytochemical investigation

Convolvulus arvensis (Convolvulaceae), commonly referred to as European bindweed, is a vine that grows wild in Europe and the United States. Phytochemical studies on this plant have been limited to the detection of saponins (1), flavonoids and caffeic acid (2), alkaloids (3), and lipids (4) and to the identification of δ-aminolevulinic acid (5). Aqueous extracts of the plant have been reported to have antihemorrhagic properties (6) and phytotoxic effects by inhibiting seedling growth and germination of wheat, flax, alfalfa, and oats (7). Resins obtained from the plant have been reported to have a cathartic action in rats (8), while total alkaloid extracts, when administered to cats and rabbits, gave a hypotensive effect with vasodilation and an increase in the coronary circulatory rate (9).

EXPERIMENTAL

Plant Material—The plant material[1] used in this investigation was collected as a weed growing in Chicago, Ill., during August 1971. The aerial parts were harvested, air dried, and milled to a coarse powder.

Preparation of Crude Fractions—The coarsely milled plant material (2.3 kg.) was extracted in a soxhlet apparatus for 36 hr. with petroleum ether (b.p. 30–60°) which, after evaporation *in vacuo*, yielded 22.8 g. of petroleum ether-soluble extract. After air drying the defatted plant material, it was percolated with methanol. The methanol extract yielded 215 g. of residue after evaporation *in vacuo*.

The petroleum ether fraction (22.8 g.) was chromatographed over a column containing 1.5 kg. of Woelm neutral alumina (activity III). Elution with petroleum ether (15 l.) followed by benzene (10 l.) gave 11.1 g. of an oily residue (A) and a residue of 7.2 g. (B), respectively. The material remaining on the column was eluted with chloroform and methanol to yield a residue of 2.8 g. (C).

Identification of Alkanes in Fraction A—A mixture of alkanes (1.2 g.) was isolated by crystallization of Fraction A with hot acetone. The mixture melted at 53–54°. An IR spectrum (KBr) was typical for alkanes, with no evidence of hydroxyl or carbonyl absorption. The isolate was subjected to GC analysis using an instrument[2] fitted with a 0.05-cm. (0.02-in.) o.d. × 15.2-m. (50-ft.) SE-30 support-coated open tubular (SCOT) column. Helium (15 ml./min.) was the carrier gas. The column was maintained at 220°. Under these conditions, the sample separated into nine distinct peaks which, by comparison with reference samples, were identified (10) as *n*-pentacosane ($C_{25}H_{52}$) (4%), *n*-hexacosane ($C_{26}H_{54}$) (4%), *n*-heptacosane ($C_{27}H_{56}$) (15.1%), *n*-octacosane ($C_{28}H_{58}$) (9.7%), *n*-nonacosane ($C_{29}H_{60}$) (14.5%), *n*-triacontane ($C_{30}H_{62}$) (13.7%), and *n*-hentriacontane ($C_{31}H_{64}$) (38.6%). The remaining two peaks (<1%) were not identified.

Identification of Alkanols in Fraction D—While attempting to dissolve Fraction B in benzene, some amorphous material separated and was removed by filtration. This sample weighed 1.5 g. and was designated as Fraction D. The filtrate was dried and designated as Fraction E. A mixture of alkanols (0.161 g.) was isolated from Fraction D by crystallization from hot acetone. The mixture melted at 76–77°. An IR spectrum (KBr) showed absorption peaks at 3300 (OH), 730, and 720 [$(CH_2)_x$] cm.$^{-1}$. Analysis of this isolate was effected by gas chromatography, using an instrument[3] fitted with a 0.63-cm. (0.25-in.) o.d. × 1.8-m. (6-ft.) glass column packed with 3% OV-1. Helium (120 ml./min.) was the carrier gas. The column was maintained at 220°. Under these conditions, the isolate separated into seven peaks which were identified by reading from a linear curve constructed by plotting reference sample homologs against the log of their respective retention times. The peaks were identified as *n*-octadecanol (C_{18}) (trace), *n*-nonadecanol (C_{19}) (trace), *n*-eicosanol (C_{20}) (trace), *n*-heneicosanol (C_{21}) (22.8%), *n*-tetracosanol (C_{24}) (37.5%), and *n*-hexacosanol (C_{26}) (35.3%). A peak (3%) between the C_{20} and C_{21} alcohols was unidentified.

Isolation and Identification of α-Amyrin—TLC of Fraction E on silica gel G plates, developed with a solvent system composed of benzene–acetone (6:1) and sprayed with sulfuric acid followed by heating, showed four spots. The sample was chromatographed over a column packed with 600 g. of silica gel PF_{254}. The adsorbent was first activated by heating at 105° overnight and then deactivated with 10% (w/v) distilled water. It was packed with the above-mentioned solvent system. The column was eluted with the same solvent system and 20-ml. fractions were collected. Fractions 1–10 from the column gave a yellow oil (3.1 g.), fractions 12–20 (1.45 g.) yielded a crude triterpene, and fractions 23–27 (1.08 g.) afforded a mixture of sterols. The crude triterpene was crystallized from ethanol to afford 50 mg. of colorless needles, m.p. 178–180° [lit. (11) m.p. 183°); $[\alpha]_D^{25}$ + 92° (concentration, 0.5 in benzene) [lit. (11) $[\alpha]_D^{25}$ + 90° in benzene]. An acetate was prepared in the usual manner and it was found to have m.p. 219–221° [lit. (11) m.p. 220–227°]. The identity of the compound as α-amyrin was further established by an IR spectrum (KBr), which was superimposable with that of an authentic sample of α-amyrin, and a mixed melting point with an authentic sample of α-amyrin, which was undepressed. A mass spectrum of the isolate gave a molecular ion at *m/e* 426 and exhibited a fragmentation pattern that was in agreement with that published for α-amyrin (12).

Identification of Campesterol, Stigmasterol, and β-Sitosterol—The mixture of sterols isolated from Fraction E was crystallized from ethanol to yield a product exhibiting m.p. 134–135°. TLC of the isolate showed a single spot identical with β-sitosterol, but GC

[1] Voucher specimens were prepared and identified as *Convolvulus arvensis* L. (I-2344) and are deposited in the Herbarium of the Department of Pharmacognosy and Pharmacology, College of Pharmacy, University of Illinois at the Medical Center.

[2] Perkin-Elmer model 800.

[3] Varian Associates.

analysis showed it to be a mixture of three sterols. The mixture was analyzed using an instrument[4] fitted with a 0.63-cm. (0.25-in.) o.d. × 1.8-m. (6-ft.) glass column packed with Gas Chrom Q, 100–120 mesh, and coated with 5% OV-101. Helium was used (80 ml./min.) as the carrier gas, and the column was maintained at 250°. Cholestane was used as the internal standard. The sterols were identified as campesterol (15.6%), stigmasterol (6.2%), and β-sitosterol (78.2%) by comparison of the relative retention times of the eluted sterols with reference samples of authentic sterols.

[4] Perkin-Elmer model 881.

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Synthesis of Potential Antineoplastic Agents XXII: Compounds Related to 1-Nitro-3-[(*p*-phenylbenzylidene)amino]guanidine

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Abstract □ The nitroguanylhydrazone of 4-biphenylcarboxaldehyde exhibits antineoplastic activity in the Walker 256 and KB test systems. Other nitroguanylhydrazones and other derivatives of 4-biphenylcarboxaldehyde were prepared and found to be devoid of antineoplastic activity.

Keyphrases □ 1-Nitro-3-[(*p*-phenylbenzylidene)amino]guanidine, related compounds—synthesized and screened as potential antineoplastic agents □ Antineoplastic agents, potential—synthesis of compounds related to 1-nitro-3-[(*p*-phenylbenzylidene)amino]-guanidine, screened against Walker 256 and KB test systems □ 4-Biphenylcarboxaldehyde derivatives—synthesized and screened as potential antineoplastic agents □ Nitroguanylhydrazones—synthesized and screened as potential antineoplastic agents

In connection with other work in progress in this laboratory, the nitroguanylhydrazone of 4-biphenylcarboxaldehyde (I) was prepared. In routine screening, this compound was found to possess antineoplastic activity against Walker carcinosarcoma 256 (Table I) and had confirmed activity against KB cell culture. To explore this lead further, a series of nitroguanylhydrazones and some derivatives of 4-biphenylcarboxaldehyde were prepared for screening. Nitroguanylhydrazones were previously used to identify aldehydes and

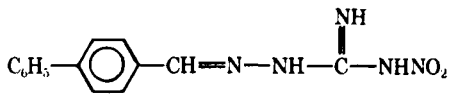

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Table I—Summary of Screening of 1-Nitro-3-[(*p*-phenylbenzylidene)amino]guanidine against Walker Carcinosarcoma 256 (Subcutaneous) in Fischer 344 Rats[a]

Vehicle	Day of First Injection	Number of Injections	Dose, mg./kg.	Animal Weight —Percent— Difference T−C[b]	T/C[c]
Hydroxypropylcellulose[d]	1	9	400	−6	150
	1	9	200	−2	138
	1	9	100	−2	116
	3	4	400	−1	166
	3	4	200[e]	1	177
	3	4	100	−2	116
Saline with polysorbate 80	1	9	400	−7	144
	1	9	200	−2	133
	1	9	100	−5	144
	1	9	50	1	150
	3	4	400	−8	144
	3	4	200	−4	127
	3	4	100	1	111

[a] Supplied by Drug Research and Development, Chemotherapy, National Cancer Institute. Intraperitoneal administration was made daily, with evaluation on Day 30. In all cases, there was 6/6 survivors. [b] Average weight change of test group minus average weight change of control animals in grams. [c] Ratio of survival time of treated to control animals expressed as percent. [d] Klucel. [e] Two cures.