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SHORT REPORTS

ISOLATION OF PARASORBIC ACID FROM THE CRANBERRY PLANT, *VACCINIUM MACROCARPON*

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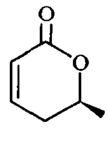
Key Word Index—*Vaccinium macrocarpon*; Ericaceae; cranberry; parasorbic acid; seed germination inhibition.

Abstract—Parasorbic acid, 5,6-dihydro-6(*S*)-methyl-2H-pyran-2-one, has been isolated from whole plant extracts of the cranberry, *Vaccinium macrocarpon*. This antibiotic lactone, which also inhibits seed germination, has been reported previously only from the fruit of the mountain ash, *Sorbus aucuparia*.

Parasorbic acid, **1**, has been known for over a century [1] to be a constituent of the fruits of *Sorbus aucuparia* (Rosaceae). This unsaturated lactone has been shown to inhibit fungal growth [2] and seed germination [3, 4]. More recently, it has been reported [5] that **1** is derived from the glucoside **2** in *Sorbus* fruits. To our knowledge, neither **1** nor **2** has been reported from any natural source other than *Sorbus*.

In the course of an examination of cranberry plant extracts for alkaloids, we isolated parasorbic acid, **1**, from a methanol-soluble fraction in 0.12% yield (based on plant dry wt). Since the plant extracts were exposed to acid during the solvent partitioning sequence which led to the isolation of **1**, it is possible that **1** is produced by acid hydrolysis of **2** or a related glycoside. The ^{1}H NMR spectrum indicated the presence of eight protons—a methyl group, an allylic methylene, a methine on carbon bearing a heteroatom and two olefinic protons. Decoupling experiments led to partial structure **1a**. The IR spectrum gave evidence for the presence of an ester or lactone and the absence of hydroxyl groups. The mass spectrum showed a molecular ion at *m/e* 112; in conjunction with the IR spectral data, this suggested that the elements of CO_2 were missing from **1a**. The identification of **1** was confirmed by comparison of the reported optical rotation [6] and UV [7], IR [7], MS [8] and ^{1}H NMR [9] spectra of parasorbic acid with those of our compound.



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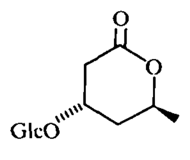

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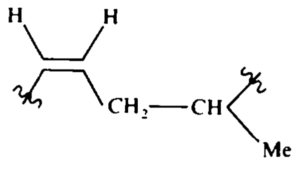

1a

Inhibition of seed germination and plant growth by extracts of cranberry plants has recently been demonstrated (R. M. Devlin, personal communication). Since **1** is known to exhibit such inhibitory activity against a variety of plants [3, 4], it may well be responsible for the allelochemical activity in *V. macrocarpon* and, at the same time, offer some protection to the plant from fungal infection.

EXPERIMENTAL

^{1}H NMR spectra were obtained using a Varian EM-390 Spectrometer; chemical shifts are reported in δ units (ppm) relative to TMS ($\delta = 0$) as an internal standard in $CDCl_3$.

Isolation of **1**. The aerial portion of *Vaccinium macrocarpon* was air-dried (382 g) and Soxhlet-extracted, first with petrol, then with CH_2Cl_2. The plant residue was then steeped in MeOH for 2 days. The MeOH extracts were reduced in vol. to 450 ml, diluted to 500 ml with 0.5 M HCl, and extracted with hexane; the acidic aq. MeOH phase was subsequently diluted to 75% MeOH with distilled H_2O, extracted with CCl_4, and then further diluted to 65% MeOH and extracted with $CHCl_3$. MeOH was removed from the aq. phase at red. pres.; the residual suspension was diluted to 500 ml with H_2O and extracted with EtOAc. Finally, the aq. phase was made basic with K_2CO_3 and extracted with $CHCl_3$. The $CHCl_3$ extracts were dried and reduced, *in vacuo*, to give a pleasant-smelling brown oil, 890 mg. Sephadex LH-20 gel filtration of 65 mg of the oil, using CH_2Cl_2–MeOH (1:1), gave 32 mg of **1**, a colorless mobile oil, $[\alpha]_D^{25} + 181°$ (EtOH, *c* 1.0) [lit. [6] $[\alpha]_D^{25} + 197°$ (EtOH, *c* 6.3)]; ^{1}H NMR: δ 6.95 (1 H, *ddd*, $J = 10, 5, 3$ Hz), 5.98 (1 H, *dt*, $J = 10, 1.5$ Hz), 4.57 (1 H, *dq*, $J = 9, 6$ Hz), 2.33 (2 overlapping 1H, *ddd*, $J = 9, 3, -14$ and $J = 6, 5,$

-14 Hz), 1.45 (3 H, *d*, $J = 6$ Hz); UV; $\lambda_{\max}^{\mathrm{EtOH}}$ 221 nm (ε 8100); IR ($CHCl_3$) cm^{-1}: 2960, 2920, 2900, 1730, 1635, 1465, 1455, 1400, 1365, 1310, 1265, 1125, 1110, 1055, 1000, 955, 855; MS *m/e* (rel. int): 112 (2), 97 (7), 68 (100), 40 (15), 39 (13).

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