Fokienia hodginsii Seed Oil, Another Source of All-*cis* 5,9,12,15-18:4 (Coniferonic) Acid

Sir:

An unusual octadecatetraenoic acid with the structure all-*cis* 5,9,12,15-18:4 was shown to occur in the leaf lipids of conifers by Jamieson and Reid (1) in 1972. Later, this acid was characterized in Norway spruce (*Picea abies*) wood by gas–liquid chromatography–mass spectrometry (GLC–MS) of its trimethylsilyloxy derivative (2). More recently, this acid was detected in the seed lipids of many conifers, though at levels most often less than 0.1% of total fatty acids (3). However, among approximately 170 species analyzed so far, an exception was found: *Chamaecyparis lawsoniana* (Lawson false cypress), an important North American species also widely planted elsewhere as an ornamental tree. The concentration of the 5,9,12,15-18:4 acid relative to total fatty acids (2.0%; Table 1, and Ref. 3) was sufficient to allow characterization of its structure by GLC–MS of the 4,4-dimethyloxazoline (4) and picolinyl ester (Christie, W.W., and R.L. Wolff, unpublished data) derivatives. However, this concentration was too low to allow characterization by ^{13}C nuclear magnetic resonance (5).

Owing to the ubiquity of 5,9,12,15-18:4 acid among conifers, the trivial name coniferonic acid was suggested (6). However, this acid also occurs at relatively low levels in the seeds of a few archaic angiosperm species, e.g., some *Cimicifuga* species and *Caltha palustris* (7). Coniferonic acid is probably the Δ5-desaturation product of 9,12,15-18:3 acid (3), although another biosynthetic pathway, the Δ15-desaturation of 5,9,12-18:3 (pinolenic) acid, is also theoretically possible.

During the course of our systematic study of gymnosperm seed lipids, we found another species, *Fokienia hodginsii*, with seed lipids that have a higher level of coniferonic acid (2.8%; Table 1) than those from *C. lawsoniana*. *Fokienia hodginsii* forms dense forests at an altitude of about 2000 m in Laos, but it also grows in Vietnam and southeastern China. The oil content of *F. hodginsii* seeds is slightly higher than that of *C. lawsoniana*, 27.7 vs. 24.0% (wt% of oil relative to undehulled seeds for both species). Both *C. lawsoniana* and *F. hodginsii* belong to the Cupressaceae family, the members of which have seed lipids generally rich in 9,12,15-18:3 acid, in contrast to species of the Pinaceae family (3). However, coniferonic acid was less than 0.3% in all other species of the Cupressaceae family that we have analyzed [other *Chamaecyparis* species, several species of the *Juniperus, Cupressus*, *Platycladus, Austrocedrus, Thuya,* and *Calocedrus* genera, totaling 22 species (3,6; Wolff, R.L., F. Pédrono, and A.M. Marpeau, unpublished data)]. Species of the Taxodiaceae family, which is taxonomically closely related to the Cupressaceae family, also have seed lipids rich in 9,12,15-18:3 acid, but here too, coniferonic acid is present at levels lower than 0.1%, at least in species of the genera *Taxodium, Cunninghamia, Metasequoia, Sequoiadendron, Sequoia*, and *Cryptomeria* [nine species analyzed (3; Wolff, R.L., F. Pédrono, and A.M. Marpeau, unpublished data)].

In conclusion, among 31 species of the Cupressaceae and Taxodiaceae families analyzed so far, only *C. lawsoniana* and *F. hodginsii* have seeds with an interesting level of coniferonic acid, particularly when considering that it represents *ca.* 50% of total Δ5-olefinic acids in both species. Nevertheless, the absolute proportion of coniferonic acid in the seed lipids

TABLE 1
Fatty Acid Composition of the Seed Lipids from *Fokienia hodginsii*. Comparison with *Chamaecyparis lawsoniana*[a]

	Weight percentage[b]	
Fatty acid	*F. hodginsii*	*C. lawsoniana*
16:0	6.07	5.22
16:1	0.05	0.30
17:0	0.08	0.06
18:0	3.09	2.16
9-18:1	10.55	10.51
11-18:1	0.23	0.25
9,12-18:2	33.18	24.88
9,12,15-18:3	40.07	50.03
20:0	0.15	0.23
11-20:1	0.18	0.16
11,14-20:2	0.06	0.16
5,9-18:2	0.19	0.17
5,9,12-18:3	0.85	0.49
5,9,12,15-18:4	2.82	1.99
5,11-20:2	0.27	0.28
5,11,14-20:3	0.28	0.46
5,11,14,17-20:4	0.80	0.75

[a]The seeds were purchased from Sandeman Seeds, Pulborough, United Kingdom. The commercial origin of *C. lawsoniana* seeds analyzed here is not the same as in Reference 3. Oil extraction, fatty acid methyl ester preparation, gas–liquid chromatography conditions, and peak identification are as described previously (3,4).
[b]Mean of analyses of two fatty acid methyl ester preparations for each species (wt% relative to total fatty acid methyl esters).

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from both species seems limited, despite the fact that their content in 9,12,15-18:3 acid, the putative precursor of coniferonic acid, is among the highest found in conifer seed lipids. In the seed lipids from *Cimicifuga* species (7), the proportion of coniferonic acid is also apparently limited (maximum, 2.3% of total fatty acids), but this acid is accompanied by two other Δ5-olefinic acids, 5,11,14-20:3 (sciadonic) and 5,11,14,17-20:4 (juniperonic) acids, in amounts larger than in *C. lawsoniana* and *F. hodginsii*.

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