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SEED EPICUTICULAR WAX OF *AVENA SATIVA*

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Key Word Index—*Avena sativa*; Gramineae; oats; seed epicuticular wax; β-diketones; alkanols; hydroxy-β-diketones; esters.

Abstract—The main fractions in oat seed wax are β-diketones (15.5%), alkanols (14.4%), hydroxy-β-diketones (12.2%), esters (11.1%) and fatty esters (7.2%).

INTRODUCTION

Both leaf and seed epicuticular waxes of *Avena* varieties have been analysed [1–3]. As there is a description of *A. sativa* L. subsp. *diffusa* var. Kelsey leaf wax [1], the study of this seed wax was particularly interesting for comparison purposes since the previous studies on seed waxes do not cover the analysis of all fractions [2, 3].

RESULTS AND DISCUSSION

The wax extracted represented 0.9% of the dry weight of the seeds. The quantitative TLC and GC analyses of the fractions are shown in Tables 1 and 2.

When compared to the seed wax from cv Sure Grain variety [3], the wax shows the same fractions. In cv Kelsey, the ketone fractions are quite important whereas they are traces for cv Sure Grain. The hydrocarbon and alkanol constituents are more important in cv Sure Grain, and the sharply defined acid composition of cv Sure Grain is absent in cv Kelsey, where a more complex range of acids is present.

Table 1. Composition of wax of *A. sativa* L. subsp. *diffusa* var. Kelsey seeds (wt % determined by preparative TLC)

Fraction	R_f	Percentage	Components
I	0.11	8.8	Free acids
II	0.26	12.2	Hydroxydiketones
III	0.30	14.4	Free alkanols
IV	0.42	tr	Unknown*
V	0.60	11.1	Esters
VI	0.72	15.5	β-Diketones
VII	0.86	7.2	Esters
VIII	0.97	8.8	Hydrocarbons

TLC conditions are described in the Experimental.
*Apparently triglycerides.

Comparison of the oat seed wax cv Kelsey with the total plant wax [1] shows the same fractions, with the exception of the ester fraction, but there is not the predominance of the free alkanols observable in the latter. The ketone fractions are more important for the seed wax. The fractions themselves are different since in the seed wax the hydrocarbons have shorter chains, and the free and esterified alkanols do not show a predominance of any one component (as in the case for C_{26} for the total plant wax [1]) with high percentages of C_{26}, C_{28}, C_{30} and C_{32} compounds. The esterified acids are longer while the free acids are shorter in the seed wax. Fraction V esters, absent in cv Sure Grain seed wax, have a TLC behaviour similar to that of the esters described in *Arundo donax* seed wax and to that of diol esters presen in *Triticum* [4], *Agropyrum* [5] and *Secale* [6] waxes. The difficulty in isolating the diol components after hydrolysis points to short-chain diols.

EXPERIMENTAL

Plant material. Avena sativa L. subsp. *diffusa* (Neils.) Asch. and Graeb. var. Kelsey seeds were supplied by Dr. A. P. Tulloch, PRL, NRCC (Saskatoon, Canada).

Wax extraction. The seeds were washed with petrol–Et_2O (60:80) (15 sec). The wax was recovered on evapn of the solvent (288 mg wax from 320 g dry seeds)

Wax fractionation. The wax (18.1 mg) was fractionated by prep. TLC as described previously [3, 7], using $CHCl_3$–MeOH (19:1) as the first solvent system and petrol or petrol ether (40–60°) C_6H_6 (3:1) as the second solvent system. Eight fractions were separated by elution (I, 1.6 mg; II, 2.2 mg; III, 2.6 mg; IV, traces; V, 2.0 mg; VI, 2.8 mg; VII, 1.3 mg; VIII, 1.6 mg). TLC/GC analysis of hydrocarbons, esters, free acids and free alkanols was carried out under the conditions described previously [3, 7]. β-Diketones and hydroxy-β-diketones were developed by spraying with Fast Blue B reagent [2, 8]. The GC/MS trace for fraction VI (β-diketones) corresponded to 14,16-hentriacontanedione, with no other discernible components.

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Table 2. Composition of wax fractions from *A. sativa* L. subsp. *diffusa* var. Kelsey seeds (wt % determined by GC)

No. of C atoms	Hydrocarbons	Esters, alcohols	Acids	Free alcohols	Free acids	Acids, fraction V
12			5		2	
14			9		13	48
16			8		40	18
18			14		31	16
19	4					
20	tr*		7	4		
21	3					
22	1		20		14	18
23	5					
24	2	3	26	4		
25	20					
26	1	34	6	29		
27	22					
28		21		19		
29	23					
30		19		24		
31	10					
32		20		20		
Unknown	9 (1)		5 (2)			

Figures in parentheses indicate the number of unidentified components.
*tr = components below 1% concentration.

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