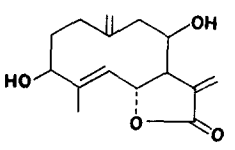
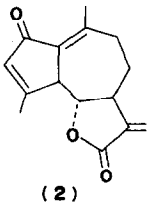
codin (**2**). They were identified by their IR, NMR, mp and mmp with authentic samples.



(**1**)



(**2**)

Three sesquiterpene lactone chemical races, (low elevation), (high elevation) and (Hot Springs), have been reported in *A. tridentata* ssp. *vaseyana* from Montana [1, 2]. Arbusculin-A, -B and -C were isolated from the (low elevation) race [3]. Arbusculin-A, -B, -C, rothin-A and -B were detected in the (Hot Springs) race [1]. Artevasin (**1**) and dehydroleucodin (**2**) were isolated from plants of the (high elevation) race. Artevasin (**1**) has been previously reported from *A. tridentata* ssp. *vaseyana* in Wyoming [4], *A. tripartita* Rydb. ssp. *tripartita* in Montana [5], and *A. cana* Pursh ssp. *cana* [6] in Montana. Dehydroleucodin (**2**) has been previously reported from the native South African species *Lidbeckia pectinata* Berg [7].

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1,8,11,14-HEPTADECATETRAENE FROM *CARTHAMUS TINCTORIUS*

RONALD G. BINDER, WILLIAM F. HADDON, ROBERT E. LUNDIN and ANTHONY C. WAISS

Western Regional Research Laboratory, Agricultural Research Service, U.S. Department of Agriculture, Berkeley, CA 94710, U.S.A.

and

JOHN M. KLISIEWICZ

Agricultural Research Service, U.S. Department of Agriculture, University of California, Davis, CA 95616, U.S.A.

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Key Word Index—*Carthamus tinctorius*; Compositae; safflower; 1,8,11,14-heptadecatetraene.

Plant. Carthamus tinctorius L. Source. California—a commercial variety of safflower seed. *Previous work.* Isolation and characterization of heptadecatetraene from roots of *Saussurea lappa* Clarke [1–3].

Present work. While investigating volatile compounds from germinating safflower, we identified (Z,Z,Z)-1,8,11,14-heptadecatetraene. Safflower seed, soaked for 2 hr in H_2O, was allowed to germinate for 4 days in a flask through which air flowed and to which H_2O was occasionally added. Seedlings were extracted with Et_2O and a concentrate of volatile compounds was obtained by vacuum steam distillation. Fractionation of

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Table 1. NMR spectral data for 1,8,11,14-heptadecatetraene

δ	No. of protons	Type	J (Hz)	Interpretation
0·98	3	*t*	8	$C\underline{H}_3-CH_2-$
1·36	6	*bs*		$-CH_2-(C\underline{H}_2)_3-CH_2-$
2·05	6	*m*		$-CH_2-C\underline{H}_2-CH=$
2·81	4	*t*	5	$=CH-C\underline{H}_2-CH=$
4·94	1	*d,m*	10	$-CH_2-\underline{H}-(-C=C-)-\underline{H}-H$
4·98	1	*d,m*	17	$-CH_2-\underline{H}-(-C=C-)-\underline{H}-\underline{H}$
5·37	6	*m*		Nonconjugated vinyl H
5·84		*d,d,t*	17,10,6	$-CH_2-C\underline{H}=CH_2$

these compounds was effected on a Si gel H column with hexane–Et_2O.

GLC on a Silar 5CP column indicated that one component constituted 96% of one fraction. An exact mass measurement with a DuPont (CEC) 21-110A high resolution mass spectrometer gave $C_{17}H_{28}$ as the molecular formula. MS: M^+ *m/e* 232 (4%), 108 (80), 95 (48), 93 (48), 91 (29), 81 (39), 80 (56), 79 (100), 67 (65), 55 (36), 41 (37). The 100 MHz NMR spectrum was taken in $CDCl_3$ with TMS as internal standard. Analysis of the spectrum (Table 1), aided by double resonance decoupling experiments, established the identity of the hydrocarbon as 1,8,11,14-heptadecatetraene.

The IR spectrum of the heptadecatetraene (neat) accords with that described by Romaňuk *et al.* [2], showing peaks at 3012, 1641, 992 and 911 cm^{-1}. No peak at 974 cm^{-1} showing *trans* unsaturation is present, so the disubstituted double bonds have the *cis* configuration. The UV spectrum of a sample purified by GLC shows a continually increasing absorption from 220 nm to the instrument cutoff point at 182 nm (ϵ 38400) (cyclohexane) with an inflection at 193 nm (ϵ 26300). (The recorded spectrum of an equimolar mixture of methyl linolenate and methyl 10-undecenoate is very similar in shape and intensity).

The amount of heptadecatetraene in a hexane–acetone extract of 4-day-old seedlings grown from 1000 g seed was 0·28 g. An estimate of the amount of heptadecatetraene in a hexane–acetone extract of 4-day-old seedlings showed 0·028%.

Carthamus tinctorius and *Saussurea lappa*, the only plants in which the presence of 1,8,11,14-heptadecatetraene is reported, are both members of the tribe Cynareae.

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ECHINATINE AND SUPININE: PYRROLIZIDINE ALKALOIDS FROM *EUPATORIUM CANNABINUM*

ERLING PEDERSEN

Chemical Laboratory B, The Royal Danish School of Pharmacy, Universitetsparken 2, DK 2100 Copenhagen O, Denmark

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Key Word Index—*Eupatorium cannabinum*; Compositae; pyrrolizidine alkaloids; echinatine; supinine.

Plant. *Eupatorium cannabinum* L.—Compositae. *Source.* Vaserne, north of Copenhagen. Voucher specimen in the herbarium of the Botanical Museum, University of Copenhagen. *Uses.* Emetic and diuretic [1]. *Previous work.* Sesquiterpene lactones [2, 3], flavonoids [4], sterols [5].

Present work. The MeOH extract of the dried aerial parts (2 kg) was evaporated and the residue