taken to see whether there were chemical differences between healthy and diseased. *Panicles.* Healthy and malformed panicles were plucked from the same tree and each was extracted in light petrol.(40–60°), Me_2CO and MeOH. Yields of the extracts were same in both the cases except for the acetone extract, which was double in the case of malformed panicles. However, the constituents of both types of panicles were found to be same. Light petrol extract; *Octadecane* (0·28%, 25%†, bp, *m/e* 254); *Bis-2-ethylhexanyl phthallate* (1·40%, 1·28%*, bp, TLC, IR, NMR; hydrolysis-phthallic acid; mp, mmp, IR; 2-ethyl hexanol-IR, NMR, GLC, mixed GLC, *m/e* 130); n-*Octacosanol* (0·16%, 0·12%*, *mp, IR, m/e* 410); *Sitosterol* (0·28%, 0·18%*, mp, mmp; TLC, IR); *Palmitic acid* (0·22%, 0·30%*, mp, methyl ester bp, IR, GLC, mixed GLC, *m/e* 270). Acetone extract; *Gallic acid* (Major, 4·20%, 8·68%*, mp, mmp, IR, UV; methyl gallate (mp; mmp, IR, UV, TLC); *Dimethylellagic acid* (0·56%, 1·50%*, mp, mmp, IR, UV, negative Griessmayer test [11]. Methanol extract; *Methyl gallate* (3·00%, 3·20%*, formed during extraction in contradiction to the observations of Singh and Bose [6], mp, mmp, IR, UV, TLC); *Gallic acid* (4·86%, 5·60%*); *Ellagic acid* (1·12%, 0·88%*; IR, UV, positive Griessmayer test); Meso-*Inositol* (1·00%, 0·58%*; mp, mmp, IR, Hexacetate—mp, mmp, IR); *Galactose* (Major carbohydrate, 1·02%, 0·88%*; R_f on ppc.).

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REFERENCES

1. Bhatia, V. K., Ramanathan, J. D. and Seshadri, T. R. (1967) *Tetrahedron* **23**, 1363.
2. Nigam, I. C., Nigam, M. C. and Dhingra, D. R. (1961) *Indian Perfumer* **V (II)**, 136.
3. Younes, K. El-Garby, Osman, A. M. and Sheta, A. E. (1973) *Ind. J. Chem.* **11**, 405.
4. Baslas, K. K. (1970) *Flavour Industry* **1**, 473.
5. Bose, J. L. and Siddiqui, S. (1948) *J. Sci. Ind. Res.* **7B**, 100.
6. Singh, L. B. and Bose, J. L. (1961) *J. Sci. Ind. Res.* **20B**, 296.
7. Pathak, S. P. and Vashishta, A. K. (1961) *J. Sci. Res. (Banaras Hindu Univ.)* **12**, 41.
8. Corsano, S. and Mincione, E. (1967) *Ann. Chim. (Rome)* **57**, 508.
9. Srivastava, R. P. and Bhutani, Dhano K. (1973) *Fruits* **28**, 389.
10. Varma, Anupam, Lele, V. C. and Goswami, B. K. (1974) *(Current Trends in Plant Pathology, Botany Dept. Lucknow Univ.)* 196.
11. Srivastava, S. N., Bhakuni, D. S., Sharma, V. N. and Kaul, K. N. (1962) *J. Sci. Ind. Res.* **21B** 549.

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SESQUITERPENE LACTONES OF *ARTEMISIA TRIDENTATA* SSP. *VASEYANA*

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Key Word Index—*Artemisia tridentata* ssp. *vaseyana*; Compositae; sesquiterpene lactones; artevasin; dehydroleucodin.

Plant. Artemisia tridentata Nutt. ssp. *vaseyana* (Rydb.) Beetle. *Plant part.* Leaves. *Source.* Sage Creek, Montana, T2S, R17W, Section 17, Elevation 1951 m. (Voucher Nos. 8/21/72—1–4, kept in the University of Montana).

Compounds. Column chromatography of the $CHCl_3$ extract resulted in the isolation of two sesquiterpene lactones, artevasin (**1**) and dehydroleu-

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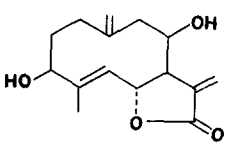
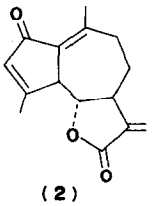
codin (**2**). They were identified by their IR, NMR, mp and mmp with authentic samples.



(**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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REFERENCES

1. Kelsey, R. G., Morris, M. S., Bhadane, N. R. and Shafizadeh, F. (1973) *Phytochemistry* **12,** 1345.
2. Kelsey, R. G. (1974) Ph.D. Dissertation, University of Montana, Missoula, Montana, U.S.A.
3. Shafizadeh, F., Bhadane, N. R., Morris, M. S., Kelsey, R. G. and Khanna, S. N. (1971) *Phytochemistry* **10,** 2745.
4. Asplund, R. O., McKee, M. and Balasubramaniyan, P. (1972) *Phytochemistry* **11,** 3542.
5. Shafizadeh, F., Bhadane, N. R. and Kelsey, R. G. (1974) *Phytochemistry* **13,** 669.
6. Shafizadeh, F. and Bhadane, N. R., unpublished results.
7. Bohlmann, F. and Zdero, C. (1972) *Tetrahedron Letters* 7, 621.

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

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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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