A Preliminary Study of Artemisia Filifolia Torrey[*]

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Few of the plants native to Nebraska have been given any attention with regard to chemical investigation. Inasmuch as one of the most widely distributed plants in western Nebraska is *Artemisia filifolia* Torr., this plant suggested itself as one worthy of investigation. A specimen of the plant under consideration was identified by Professor T. J. Fitzpatrick, Curator of the Herbarium of the University of Nebraska, as *Artemisia filifolia* Torr. So far as could be learned, no previous chemical investigation of this plant has been reported.

EXPERIMENTAL

A. COLLECTION OF MATERIAL

On October 15, 1938, 130.07 Kg. of *Artemisia filifolia* Torr. were collected in Keith County, Nebraska. Only the green, tip ends of the plant were gathered. This was accomplished by gathering up a handful of the ends and breaking them off with the aid of a large knife or by clipping them off with a pair of shears. The material was packed in paper bags and shipped to Lincoln *via* truck, arriving five days after the material had been gathered. Of the 130.07 Kg. of fresh plant collected, 112.37 Kg. were allotted for steam distillation and 17.70 Kg. were reserved for drying.

During the first week of August of 1939, 186.10 Kg. of flowering *Artemisia filifolia* Torr. were collected in the same vicinity as was the 1938 crop; the 1939 crop was handled and shipped in the same fashion as was the 1938 crop. All the material collected in 1939 was subjected to steam distillation.

B. THE SHRUB

As previously indicated, 17.70 Kg. of the fresh plant were set aside for purposes of investigating the plant itself. This material had lost 20.40 per cent of its green weight by the time it was delivered in Lincoln. The material was spread out on the floor in a thin layer and allowed to dry for five weeks in the open air. At the end of this drying period, the leaves and flowering heads were stripped from the stems and separated therefrom. The leaves and flowers were ground in a Wiley mill, using the fine screen. The stems were similarly ground.

Table I.—Loss after Drying and Grinding

	Weight in Kilos			
	Fresh Plant	Upon Receipt	After Drying	After Grinding
Stems	...	...	3.25	3.18
Leaves	...	...	7.96	7.46
Stems and leaves	17.70	14.10	11.21	10.64

	Loss in Weight	
Stems and Leaves	In Kilos	In Per Cent
Upon receipt	3.60	20.40
After drying	6.49	36.70
After grinding	7.06	40.00

The ground stems were light tan in color and had a woody odor; the ground flower-leaf portion was gray in color and had an eucalyptol-like odor.

1. MOISTURE DETERMINATIONS

The moisture content of the ground leaves and flowers as well as the ground stems was determined according to the toluene method of "The Pharmacopœia of the United States of America" (1). The water obtained from the moisture determinations was acidic to litmus paper. The percentages of water in the samples are shown in Table II.

Table II.—Percentages of Water in Air-Dried Plant

	I	II
Leaves and flowers	7.36	7.34
Stems	7.36	7.36

2. MATERIAL VOLATILE AT 105° C.

Ten-gram samples of the flower-leaf portion and of the stem portion were placed in an oven heated to 105° C. Weighings were made at twenty-four hour intervals until a constant weight was reached. After about eight days of drying, the samples had lost all perceptible odor. Constant weight was reached at the end of three weeks of drying. The percentages of material volatile at 105° C. are shown in Table III.

Table III.—Percentages of Material Volatile at 105° C.

	I	II
Leaves and flowers	11.68	11.80
Stems	8.61	8.39

3. ASH DETERMINATIONS

The ash content of the leaf-flower portion and the stem portion was determined according to methods of "The Pharmacopœia of the United States of America" (1), supplemented by methods outlined by Woodman (2). The results of these determinations are listed in Table IV.

Table IV.—Percentages of Ash in Air-Dried Plant

	Total Ash	Water-soluble Ash	Water-insoluble Ash	Acid-soluble Ash	Acid-insoluble Ash
Leaves and flowers					
I	6.35	1.27	5.08	3.26	1.82
II	6.23	1.35	4.88	3.18	1.70
III	6.42	1.41	5.01	3.11	1.90

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Table II. *(Continued)*

	Total Ash	Water-soluble Ash	Water-in-soluble Ash	Acid-soluble Ash	Acid-in-soluble Ash
Stems					
I	3.41	1.14	2.27	1.91	0.36
II	3.34	1.00	2.34	1.75	0.59
III	3.35	1.01	2.34	1.78	0.56

4. EXTRACTION WITH SELECTIVE SOLVENTS

Only the flower-leaf portion of the plant was subjected to extraction with selective solvents. Three four-hundred-gram samples of the flower-leaf portion were extracted with a series of selective solvents according to a modification of the method as originally proposed by Dragendorff (3).

The solvents employed, in the order in which they were applied, were as follows: petroleum ether, ether (tech.), chloroform (tech.), alcohol, water, one per cent aqueous hydrochloric acid solution and two-tenths per cent aqueous sodium hydroxide solution. Extraction with the first four solvents (petroleum ether, ether, chloroform and alcohol) was carried out in an extraction apparatus similar to that proposed by Wester (4) for continuous extraction; the temperature of the solvent in contact with the sample was somewhat below the boiling point of the solvent during these extractions. The water and hydrochloric acid extractions were carried out in open beakers at the temperature of the boiling solvent. The sodium hydroxide extraction was made at a temperature of about 75° C. Constant stirring was employed during this extraction in order to prevent superheating of the bottom of the beaker; breakage of a number of beakers resulted from this cause prior to the employment of mechanical stirrers.

The various extractions were carried to practical completion as was indicated by the absence of color in the solvent or the absence of residue when a few cubic centimeters of the solvent were evaporated to dryness. The extracts obtained have not been investigated as to their composition.

The percolates from the petroleum ether, ether, chloroform and alcohol extractions were placed in large evaporating dishes and the solvent allowed to evaporate spontaneously or by gentle warming, if necessary.

The filtrates from the hot water extractions were placed in evaporating dishes and heated on the steam bath until the water was removed. The filtrates from the acid extractions were neutralized with aqueous sodium hydroxide; the precipitates which formed upon neutralization (if any) were filtered off and dried; the resulting filtrates were then evaporated under reduced pressure. The filtrates from the alkali extractions were neutralized with hydrochloric acid; the precipitates which formed upon acidification (if any) were filtered off and dried; the filtrates obtained were then evaporated under reduced pressure.

(*a*) *The Marc.*—The residue remaining after this treatment was a tasteless, odorless, tan powder which still contained a considerable number of coarse particles. These particles were probably pieces of stem which were unavoidably included with the flower-leaf portion during the mechanical separation of the stems from the flowers and leaves.

The total extraction time and the percentage of extracted material obtained with each solvent are listed in Table V. The weights of the acid extracts and the alkali extracts were found by the differences in the weights of the air-dried samples before and after the respective extractions. This obviated the difficulty involved in determining accurately the amount of sodium chloride present as a contaminant in the acid and alkali extracts.

Table V.—Extraction with Selective Solvents

Solvent Employed	Number of Extractions	Extraction Time in Hours I	II	III	Per Cent of Extract[a] I	II	III
Petroleum ether	Continuous	82.75	83.00	82.75	4.51	4.21	4.22
Ether	Continuous	229.00	227.75	227.75	13.75	15.50	13.54
Chloroform	Continuous	101.50	101.50	101.50	1.94	2.24	2.04
Alcohol	Continuous	411.75	414.75	414.50	11.43	12.16	11.24
Water	31	108.50	108.50	108.50	24.80	24.73	24.75[b]
Acid	15	140.25	140.00	140.25	17.19	16.93	17.66
Alkali	11	254.25	254.25	254.25	15.51	15.99	14.65
Marc	..	....	....	....	6.61	6.21	5.53
Water in air-dried plant	..	....	....	....	7.36	7.34	(7.35)[c]
Totals[d]					103.10	105.31	100.98

[a] The percentages of extract are based on the weight of the air-dried, flower-leaf portion of the plant taken for the samples.
[b] A few grams of the sample were lost during this extraction as the result of an accident.
[c] This value was not determined; it represents the average value of Samples I and II.
[d] The excessive totals may be accounted for by hydrolysis or oxidation of components or the incomplete removal of solvents.

C. THE VOLATILE OILS

1. DISTILLATION OF THE FRESH PLANT

As was previously indicated, 85.61 Kg. (112.37 Kg. green weight) of the 1938 crop and the total 1939 crop of 186.10 Kg. were set aside for steam distillation. This was carried out by charging a large, steel steam-still with about 10 Kg. of the fresh plant and distilling during a period of from two to three hours. The steam used was taken directly from a line carrying steam under a pressure of thirty pounds per square inch.

The distillate was collected in a Florentine receiver. A total volume of 70 cc. of reddish brown oil separated from the distillate obtained from the 1938 plant. From the steam distillation of the 1939 crop, a total volume of 204 cc. of oil, darker in color than the 1938 oil, was obtained. Approximately twenty liters of aqueous distillate were collected from each charge of fresh plant. The aqueous, oil-saturated distillates were definitely acidic to litmus. Cohobation of these distillates, under both reduced and atmospheric pressure, failed to yield any additional oil.

The oil which separated spontaneously from the aqueous distillates was removed from the Florentine receiver and dried over anhydrous sodium sulfate.

The aqueous distillates, after separation of the oil therefrom, were extracted with petroleum ether in order to obtain whatever oil had dissolved in the water; ninety liters of the distillate were not extracted but set aside for possible future investigation. The extraction was carried out by placing about ten liters of the distillate and two liters of petroleum ether in a twenty-liter bottle, stoppering securely, and agitating for one-half hour on a shaking machine. The aqueous layer was then removed and discarded. The petroleum ether portion was used to extract the next portion of distillate. At the end of the extraction of the 1939 distillates, the petroleum ether layer had the appearance of an emulsion. About three hundred Gm. of anhydrous sodium sulfate were added to the emulsified petroleum ether. Upon absorption of water, the sodium sulfate solidified into a cake. This cake was allowed to dry by evaporation of the petroleum ether, powdered and extracted by percolation with several portions of petroleum ether. The extraction yielded, upon spontaneous evaporation of the solvent, 48 cc. of reddish brown oil somewhat lighter in color than that separating directly from the water. No difficulty was encountered with the petroleum ether extraction of the 1938 distillates; upon evaporation of the petroleum ether, 26 cc. of a reddish orange oil were obtained. The oils obtained are hereafter designated as the 1938 oil, the 1938 extracted oil, the 1939 oil and the 1939 extracted oil.

The percentage yields of the oils separating spontaneously from the aqueous distillates were as follows: 1938 oil—0.08 per cent; 1939 oil—0.10 per cent. The percentage yields of the oils extracted from the aqueous distillates were as follows: 1938 extracted oil—0.03 per cent; 1939 extracted oil—0.03 per cent. These percentage yields were based on the weight of plant upon its receipt in Lincoln.

2. SOME PHYSICAL PROPERTIES OF THE OILS

(*a*) *Specific Gravity.*—The specific gravity of the various oils was determined according to the usual method by use of a pycnometer. The specific gravities for the several oils are shown in Table VI.

(*b*) *Specific Optical Rotation.*—Ethereal solutions of the oils, prepared by dissolving 2.0 cc. of oil in enough ether to make 20.0 cc. of solution, were examined in 100-mm. tubes for determining the specific optical rotations of the oils. However, a 200-mm. tube was used for the 1938 oil. The values are shown in Table VI.

(*c*) *Refractive Index.*—The refractive indices of the oils, as determined by the use of an Abbé refractometer, are shown in Table VI.

Table VI.—Physical Constants of the Oils

	Specific Gravity	Specific Rotation	Refractive Index
1938 Oil	$0.9268\ \frac{25^\circ}{25^\circ}$	$-29.56\ \frac{20^\circ}{\mathrm{D}}$	$1.4868\ \frac{24^\circ}{\mathrm{D}}$
1939 Oil	$0.9332\ \frac{25^\circ}{25^\circ}$	$-19.69\ \frac{20^\circ}{\mathrm{D}}$	$1.4952\ \frac{20^\circ}{\mathrm{D}}$
1938 Ext. oil	$0.9727\ \frac{25^\circ}{25^\circ}$	$+\ 9.46\ \frac{20^\circ}{\mathrm{D}}$	$1.4805\ \frac{20^\circ}{\mathrm{D}}$
1939 Ext. oil	$0.9679\ \frac{25^\circ}{25^\circ}$	$+\ 0.25\ \frac{20^\circ}{\mathrm{D}}$	$1.4851\ \frac{20^\circ}{\mathrm{D}}$

(*d*) *Congealing Point.*—A congealing point apparatus of appropriate design was employed in an attempt to determine the temperature at which the oils would solidify. Solid carbon dioxide was used as the cooling agent. The temperature of the oil was allowed to drop to −60° C. (limit of thermometer) in each instance. The oils became very viscous at this temperature. However, none of the oils completely solidified; the 1938 extracted oil still flowed at this point. No crystals of any kind could be induced to separate from any of the chilled oils.

(*e*) *Solubility in Certain Solvents.*—It was found that only the 1938 extracted oil was soluble in alcohol. However, all of the oils were soluble in absolute alcohol, ether, petroleum ether, acetone and dioxane; the 1938 oil and the 1939 extracted oil were difficultly soluble in petroleum ether.

With the exception of the 1938 extracted oil, all of the oils contained some material which was insoluble in alcohol. When these were added to alcohol, precipitation occurred, expecially with the 1938 oil. The white precipitate which formed was filtered off, dried and its melting point determined. It was impossible to obtain a sharp melting point on this material; the range was from 93° to 140° C. Recrystallization from a dioxane-ether mixture failed to change materially the melting-point range.

The alcohol-insoluble material dried quickly, powdered easily and had no tendency to become gummy or sticky even under rather heavy pressure. Further investigation of this material has not been carried out.

3. SOME CHEMICAL PROPERTIES OF THE OILS

(*a*) *Reaction toward Litmus.*—Upon treating litmus paper with each of the oils, it was found that each oil caused blue litmus to become red, thereby indicating the presence of some acidic constituent.

(*b*) *Behavior with Alkaline and Neutral Permanganate.*—When the oils were shaken with cold, neutral or alkaline potassium permanganate, immediate decolorization of the permanganate solution occurred and a copious precipitate of manganese dioxide was produced. Upon acidification of the filtrate from the reaction mixture, no insoluble acid was produced. This would indicate the probable absence of compounds yielding, upon oxidation, benzoic acid or its derivatives. The rapid decolorization of the permanganate solution would indicate the presence of some substance or substances that were easily oxidized.

(*c*) *Behavior with Bromine in Chloroform.*—Large quantities of bromine in chloroform, when added to the oils, were immediately decolorized. This would indicate the probable presence of a considerable proportion of unsaturated compounds.

(*d*) *Behavior with Nitrogen Oxychloride.*—Due to the odor of the 1939 oil, it was thought that the oil possibly contained pinene. Consequently an attempt was made to prepare the nitrosochloride derivative of pinene according to the method described by Gildemeister and Hoffmann (5). No crystalline material could be induced to separate from the reaction mixture. This would make it appear that there was little, if any, pinene in the 1939 oil.

(*e*) *Behavior with Metallic Sodium.*—When the oils were placed over freshly cut sodium, a very few bubbles made their appearance on the surface of the metal. There was no tendency for the continued evolution of hydrogen. Hence, the absence of any appreciable amount of hydroxyl groups capable of reacting with sodium has been shown.

4. CHEMICAL DETERMINATIONS ON THE OILS

(*a*) *Qualitative Elementary Analysis.*—The several oils were examined for the presence of nitrogen, sulfur and halogens. The usual sodium fusion reaction was carried out and appropriate qualitative tests performed on the aqueous alkaline filtrate obtained after leaching the fusion mixture with boiling water. Nitrogen, sulfur and halogens were shown to be absent.

(*b*) *Aldehyde and Ketone Determinations.*—(1) Qualitative Determination: Since, with the exception of the 1938 extracted oil, the various oils were insoluble in alcohol, a few drops of each oil were dissolved in about one cubic centimeter of toluene and to this solution was added a small amount of Schiff's Reagent. The presence of aldehydes in all of the oils was demonstrated.

Attempts to prepare phenyl hydrazone derivatives from the oils met with failure. Efforts to form semicarbazone derivatives were likewise fruitless.

(2) Quantitative Determination: A modification of the bisulfite method for determining the quantity of aldehydes and ketones as suggested by Gildemeister and Hoffmann (6) was followed. Due to the limited supply of oils available, 2.00-cc. samples were used and Babcock bottles were employed rather than using 10.00-cc. samples of the oils in cassia flasks.

At the end of the reaction period, the Babcock bottles were placed in the centrifuge and whirled at about fifteen hundred r. p. m. for twenty-five minutes in order to break the emulsion which had formed. The percentages of aldehyde or ketone or both by volume are shown in Table VII.

Table VII.—Percentages by Volume of Aldehyde-Ketone in Oils

	I	II	III
1938 Oil	10.0	10.0	11.0
1939 Oil	15.0	15.0	void
1938 Ext. oil	16.0	18.0	void
1939 Ext. oil	13.0	13.0	15.0

(*c*) *Phenol Determinations.*—(1) Qualitative Determination: The presence of a phenolic substance or substances was shown by Flückiger's (7) test for phenolic bodies.

(2) Quantitative Determination: The oils remaining from the aldehyde determinations were used in carrying out the quantitative estimation of the phenolic substance or substances. The oil was extracted with a three per cent aqueous solution of potassium hydroxide. The Babcock bottles were again used as substitutes for the usual cassia flasks. The diminution in the volumes of the oils was found and the percentages by volume of phenolic substances were calculated with reference to the original volume of oil, *viz.*, 2.00 cc. These percentages are listed in Table VIII.

Table VIII.—Percentages by Volume of Phenolic Substances in Oils

	I	II	III
1938 Oil	7.0	4.4	9.5
1939 Oil	1.8	1.6	15.8[a]
1938 Ext. oil	19.0	17.4	15.9
1939 Ext. oil	7.6	6.8	6.2

[a] No explanation for such a variation.

(*d*) *Acid Values.*—The acid values for the oils were determined according to the usual method. These values are shown in Table IX.

Table IX.—Acid Values of the Oils

	I	II	III
1938 Oil	7.46	7.14	7.30
1939 Oil	4.09	3.94	3.78
1938 Ext. oil	7.86	8.01	7.86
1939 Ext. oil	5.77	6.08	6.23

(*e*) *Saponification Values.*—The method of "The Pharmacopœia of the United States of America" (8) was followed in determining the saponification values for the various oils. The mixtures remaining from the acid value determinations were utilized in determining the saponification values which are tabulated in Table X. The odor of the titrated saponification mixtures resembled that of eucalyptol.

Table X.—Saponification Values of the Oils

	I	II	III
1938 Oil	29.96	38.90	36.02
1939 Oil	0.00	3.56	13.58
1938 Ext. oil	57.92	54.08	56.56
1939 Ext. oil	39.44	40.28	40.82

(*f*) *Ester Values.*—The ester values of the oils were found by subtracting the average acid value of an oil from the average saponification value for that same oil. These values are shown in Table XI.

Table XI.—Ester Values of the Oils

	1938 Oil	1939 Oil	1938 Ext. Oil	1939 Ext. Oil
Saponification value (av.)	34.96	5.72	56.18	40.18
Acid value (av.)	7.29	3.93	7.91	6.02
Ester value (av.)	27.67	1.79	48.27	34.16

(*g*) *Acetyl Values.*—The acetyl values of the four oils were determined according to the method of Gildemeister and Hoffmann (9). The acetyl values shown in Table XII were found by subtracting the average ester values of the non-acetylated oil from the average ester values of the oils after their acetylation.

Table XII.—Acetyl Values of the Oils

	1938 Oil[a]	1939 Oil	1938 Ext. Oil[a]	1939 Ext. Oil
Ester value (av.) of acetylated oil	161.04	117.81	206.20	190.08
Ester value (av.) of non-acetylated oil	27.67	1.79	48.27	34.16
Acetyl value	133.37	116.02	157.93	155.92

[a] One sample only.

(*h*) *Methoxy Values.*—Since methyl and ethyl ethers occur occasionally in volatile oils, an effort was made to determine the percentage of methoxy radical present in the oils. Perkin's modification (10) of Zeisel's method for the quantitative estimation of the methoxy group was employed. When the oils were added to the hydriodic acid, there seemed to be a liberation of iodine inasmuch as the mixture turned quite brown. Upon heating, however, the hydriodic acid layer became clear. Perhaps the iodine, if any were liberated, added on to some unsaturated linkage which may have been present. The oily layer turned dark brown to almost black as the heating of the mixture was continued. The methoxy values, as determined for the oils, are listed in Table XIII.

Table XIII.—Methoxy Values of the Oils[a]

1938 Oil	0.29
1939 Oil	0.03
1938 Ext. oil	None
1939 Ext. oil	0.58

[a] One sample for each determination.

These results would indicate that there were little ethoxy or methoxy components in any of the oils and none in the 1938 extracted oil.

5. FRACTIONAL DISTILLATION OF THE 1939 OIL

Since so little oil was available, only the 1939 oil was fractionally distilled under reduced pressure. Seventy-five cubic centimeters of the 1939 oil were placed in a long-neck, round-bottom flask into which was inserted a Hempel tube and an aspirator tube. A Brühl receiver was used to collect the various fractions. An oil bath was employed for heating the distilling flask. A water pump was used to reduce the pressure within the system to about twenty-five mm. of mercury. Seven fractions of oil were collected. Information concerning these fractions is tabulated in Table XIV.

(*a*) *The Various Fractions of Oil.*—Fraction 1 was a rather limpid, colorless oil having an eucalyptol-like odor. Fraction 2 was of a light straw color, slightly camphoraceous in odor and more viscous than fraction 1. Fraction 3 had somewhat of a camphoraceous odor, was slightly more viscous than fraction 2 and was also of a light straw color. Fraction 4 was straw colored, more viscous than fraction 3, but less camphoraceous in odor. Fraction 5 was greenish yellow, less viscous than fraction 4 and had an odor resembling that of dog fennel, *Anthemis Cotula* L. A bright bluish green color marked fraction 6; the odor and viscosity of this fraction was similar to fraction 5. Fraction 7 apparently contained considerable material resulting from thermal decomposition of the original oil. This last fraction was brownish green in color and the odor resembled that of burning rubber.

The residue which remained in the distilling flask had the appearance of rosin. It was hard, yet brittle. This material was removed from the distilling flask by using small portions of ether; alcohol was added to this solution whereupon precipitation occurred. The precipitate, when filtered off and dried, was tan to brown in color.

(*b*) *Some Physical Properties of the Fractions.*—The specific gravity of each of the seven fractions was determined by the use of a pycnometer. The refractive index of each oil was found by employing an Abbé refractometer and white light. These values are shown in Table XIV.

Table XIV.—Volumes and Some Physical Properties of the Fractions of the 1939 Oil

Fraction	Temp. Range, ° C.	Volume, Cc.	Sp. Gr. $\frac{25^\circ}{25^\circ}$	Ref. Index 20° C.
1	Up to 63	8.5	0.9278	1.4773
2	63–83	7.3	0.9548	1.4878
3	83–120	3.5	0.9613	1.4941
4	120–135	5.5	0.9508	1.4971
5	135–155	15.0	0.9394	1.5014
6	155–165	7.0	0.9620	1.5016
7	165–168	4.5	0.9716	1.5019

(*c*) *Some Chemical Properties of Some of the Fractions.*—As was previously pointed out, the odor of fraction 1 was strongly suggestive of eucalyptol. Eucalyptol was tested for according to the methods of "The Pharmacopœia of the United States of America" (11) and of Baeyer and Villiger (12). The presence of eucalyptol could not be demonstrated in spite of the resemblance in odor. The specific gravity of fraction 1 was almost identical with that of eucalyptol; however, the refractive index disagreed with that for eucalyptol.

Fraction 6 possessed a bluish green color. The possibility of the presence of azulene, a blue hydrocarbon, was considered. Sherndal (13) considered the formation of a crystalline picrate as the best method of identifying azulene. Sherndal's method (14) was applied to fraction 6 with negative results.

A portion of the residue which remained in the distilling flask was tested for the presence of rosin using Liebermann's method (15). Rosin was found to be absent.

SUMMARY

A partial chemical investigation of *Artemisia filifolia* Torr. has been made. Data are reported for moisture, volatile material and ash. The results of extraction of the flowers and leaves with selective solvents according to a modification of Dragendorff's method are given.

Steam distillation of the fresh plants in 1938 and 1939 yielded 0.08 and 0.10 per cent, respectively, of volatile oils which separated spontaneously from the aqueous distillate. Oils extracted from the aqueous distillates of 1938 and 1939 with petroleum ether amounted to 0.03 per cent in each case. The total yield of oil was therefore 0.11 per cent for 1938 and 0.13 per cent for 1939.

Certain physical and chemical constants and properties of the volatile oils are reported. Slight variations in the physical constants of the oils are to be expected inasmuch as the 1938 crop was harvested in October while the 1939 crop was collected in early August. The specific gravity and the refractive index of the 1938 oil were less than those of the 1939 oil; on the other hand, the specific optical rotation was greater in the 1938 oil than in the 1939 oil. The constants and properties reported include specific gravities; specific optical rotations; refractive indices; congealing points; solubilities in certain solvents; behavior with potassium permanganate, bromine and nitrogen oxychloride; qualitative elementary analysis; quantitative determination of aldehydes-ketones and phenols; acid, saponification, ester, acetyl and methoxy values.

Fractional distillation of the 1939 volatile oil yielded seven fractions of oil which are described. The specific gravities and refractive indices of these fractions were determined. One fraction possessing the odor of and having a specific gravity almost identical with that of eucalyptol failed to give positive evidence of the presence of eucalyptol. Another fraction was blue-green in color, suggesting the presence of azulene which was shown to be absent.

Since this is only a preliminary chemical study of *Artemisia filifolia* Torr., additional investigation will be necessary before a complete phytochemical report on *Artemisia filifolia* Torr. can be made.

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"Those who never retract their opinions love themselves more than they love the truth"—Joubert