MONARDA PECTINATA, NUTT., A PHYTOCHEMICAL STUDY.*,[1]

BY JOSEPH B. BURT.

I. The Herb.

A. WEIGHT OF THE PARTS OF THE PLANT.

About four and one-half pounds of the dried herb, which had been collected in Scottsbluff County, western Nebraska, and identified by Prof. J. E. Weaver, of the Department of Botany of the University of Nebraska, as *Monarda pectinata*, Nutt., were carefully separated into flowers, leaves, stems and roots. The weights of the air-dried materials are tabulated below. Inasmuch as most of the plants were devoid of roots, the percentages of the above ground components were recomputed because the results revealed a truer relationship.

Part.	Weight.	Percentage of: Total Weight.	Above Ground Portion.
Flower	759 Gm.	39.4	41.5
Leaf	498 Gm.	25.8	27.3
Stem	569 Gm.	29.5	31.2
Root	102 Gm.	5.3	...
	1928 Gm.	100.0	100.0

B. DETERMINATION OF MOISTURE.

The water content of the air-dried materials was determined by means of the xylene method (1), duplicate determinations being made. The percentage results are tabulated below.

	A.	B.
Flower	8.0 per cent	8.0 per cent
Leaf	8.6 per cent	8.6 per cent
Stem	8.2 per cent	8.2 per cent
Root	6.5 per cent	6.5 per cent

C. EXTRACTION WITH SELECTIVE SOLVENTS.

For the sake of a general comparison with the extractives of the two species of *Monarda* previously examined, the several parts of the plant were exhausted with selective solvents according to the modified Rosenthaler method (2) as employed by Harwood (3) in his study of *Monarda fistulosa* L. A Soxhlet extractor was employed for the petroleum ether and ether extractions. For alcohol, hot extraction in a flask connected with a reflux condenser was used. The aqueous, alkaline and acid extractions were also hot. The alkali was 0.2 per cent potassium hydroxide and the acid 1.0 per cent hydrochloric acid. The differences in the weights of the fully extracted marcs (with all six solvents) and the weights of ash are reported as crude fibre. No correction has been applied for the weight of alkali accumulated in the alkaline extractives, which causes this value to assume disproportionate percentages in some instances, especially in the extraction of the root. In this

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case, on account of the hygroscopic effect of the alkali, it was found necessary to neutralize the alkali with dilute hydrochloric acid before the extracts could be brought to dryness. The solvents were used successively in the following order: petroleum ether, ether, hot alcohol, hot water, hot aqueous alkali and hot aqueous acid. The determinations were carried out in triplicate, but in order to conserve space and at the same time afford a more ready means of comparison, the averages of the three determinations only are reported for each of the four parts of the plant. The percentages of moisture in the air-dried materials are also included in the table which follows:

	Flower, Per Cent.	Leaf, Per Cent.	Stem, Per Cent.	Root, Per Cent.
Petroleum Ether	3.27	6.76	0.65	1.21
Ether	1.55	1.83	0.53	0.52
Alcohol	7.79	9.70	5.19	5.33
Water	17.62	19.78	11.75	11.24
Alkali	39.45	17.68	28.71	69.32
Acid	9.20	13.73	9.67	6.35
Crude Fibre	18.23	10.20	42.28	33.20
Ash	2.32	4.23	0.53	1.27
Moisture	8.00	8.60	8.20	6.50

An examination of this table leads to a few observations which are significant. The relatively small proportions of petroleum-ether and ether-soluble extractive in the stem and root as compared with those of the flower and leaf are especially striking. It was noted in the examination of the xylene used in the determinations of moisture, that those portions used upon the stem and root were free from carvacrol or thymol, as determined by the Flueckiger test, while the portions used upon the flower and leaf gave positive tests. Again, the relatively high values for crude fibre in the stem and root are also noted, as well as the correspondingly low values for ash in these portions of the plant. Variations in the alkali extractives are doubtless of less significance, for the reason that the proportion of alkaline solution required to exhaust the several parts of the plant is not in strict ratio to the weight of sample used, giving rise to a lack of uniformity in the results, due to the unequal accumulation of the alkali in the extracts.

D. ASH DATA.

1. Flower.—The air-dried flowers yielded the following percentages of ash, in two determinations:

	A, Per Cent.	B, Per Cent.
Water-soluble ash	4.41	4.59
Water-insoluble ash	8.47	8.65
Total ash	12.88	13.24

The water-insoluble ash resolved itself into:

	A, Per Cent.	B, Per Cent.
Acid-soluble ash	4.90	4.80
Acid-insoluble ash	3.57	3.85

2. Leaf.—Two determinations of the air-dried material yielded the following results:

	A, Per Cent.	B, Per Cent.
Water-soluble ash	3.76	3.94
Water-insoluble ash	11.53	11.49
Total ash	15.29	15.43

The water-insoluble ash was constituted as follows:

	A, Per Cent.	B, Per Cent.
Acid-soluble ash	6.27	5.90
Acid-insoluble ash	5.26	5.59

3. Stem.—Ash determinations of the air-dried material yielded the following results:

	A, Per Cent.	B, Per Cent.
Water-soluble ash	4.33	4.54
Water-insoluble ash	3.43	3.48
Total ash	7.76	8.02

The water-insoluble ash gave the following results:

	A, Per Cent.	B, Per Cent.
Acid-soluble ash	2.85	2.91
Acid-insoluble ash	0.58	0.57

4 Root.—The air-dried material gave, for two samples, the following percentages:

	A, Per Cent.	B, Per Cent.
Water-soluble ash	2.14	2.08
Water-insoluble ash	2.74	3.17
Total ash	4.88	5.25

The water-insoluble ash resolved itself into:

	A, Per Cent.	B, Per Cent.
Acid-soluble ash	1.79	2.01
Acid-insoluble ash	0.95	1.16

For the purpose of comparison, the ash data given above are retabulated in the following, the averages of the two determinations being reported.

	Per Cent in:			
	Flower.	Leaf.	Stem.	Root.
Water-soluble ash	4.50	3.85	4.43	2.11
Water-insoluble ash	8.56	11.51	3.45	2.95
Total ash	13.06	15.36	7.88	5.06
Acid-soluble ash	4.85	6.08	2.88	1.90
Acid-insoluble ash	3.71	5.43	0.58	1.06

E. INORGANIC CONSTITUENTS OF THE ASH.

The methods followed in the analysis of the constituents of the ash were the same as those employed by Harwood (4) in his study of the inorganic constituents of *Monarda fistulosa*, L. The Cl, CO_3 and SO_4 radicals are reported for the water-soluble ash, and Ca, Mg, Al, Fe and SiO_3 for the acid-insoluble ash.

1. *Flower.*—The following results were obtained from duplicate samples:

	Per Cent.	Per Cent.
Ca	0.35	0.35
Mg	0.20	0.20
Fe	0.34	0.34
Al	1.15	1.13
Cl	0.31	0.29
CO_3	3.21	3.21
SO_4	0.64	0.59
SiO_2	0.43	0.43
Undet.	6.25	6.61

2. *Leaf.*—The following ash constituents were determined:

	Per Cent.	Per Cent.
Ca	0.29	0.36
Mg	0.19	0.20
Fe	0.27	0.27
Al	1.12	1.25
Cl	0.44	0.44
CO_3	2.92	2.94
SO_4	0.49	0.61
SiO_2	0.62	0.65
Undet.	8.95	8.71

3. *Stem.*—The quantitative analysis of the ash yielded the following percentages, computed with reference to the air-dried material:

	Per Cent.	Per Cent.
Ca	0.93	0.96
Mg	0.08	0.07
Fe	0.07	0.08
Al	0.57	0.54
Cl	0.33	0.35
CO_3	2.97	3.00
SO_4	0.50	0.46
SiO_2	0.10	0.10
Undet.	2.20	2.46

4. *Root.*—The following constituents were determined quantitatively, computed with reference to the air-dried material:

	Per Cent.	Per Cent.
Ca	0.24	0.23
Mg	0.15	0.12
Fe	0.20	0.20
Al	0.37	0.37
Cl	0.07	0.07
CO_3	1.82	1.82
SO_4	0.11	0.10
SiO_2	0.09	0.10
Undet.	1.83	2.24

In the tabulation which follows, the percentages of elements and radicals were computed with reference to absolutely dry material, for any conclusions that may be drawn from these figures should be directly comparable and not subject to cor-

rection by the differences in the moisture contents of the several air-dried materials. The values recorded are the averages of the two determinations previously reported.

	Per Cent in:			
	Flower.	Leaf.	Stem.	Root.
Ca	0.43	0.35	1.02	0.26
Mg	0.22	0.22	0.09	0.14
Fe	0.37	0.30	0.09	0.21
Al	1.24	1.29	0.60	0.40
Cl	0.33	0.48	0.37	0.07
CO_3	3.49	3.20	3.25	1.95
SO_4	0.66	0.60	0.52	0.12
SiO_3	0.47	0.70	0.11	0.11
Undet.	6.99	9.67	2.44	2.16

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THE COMPARATIVE ANTISEPTIC ACTION OF OINTMENTS AND RELATED PRODUCTS.*

BY ARTHUR H. BRYAN.[1]

INTRODUCTION.

Using modified Reddish and U. S. P. H. "Cup and Smear" methods with clinical observations wherever practicable, an attempt was made to study the bactericidal activity of 80 well-known U. S. P., N. F., N. N. R., proprietary ointments, face and dental creams.

METHOD.

In the laboratory tests, blood serum heart infusion agar with human, sheep and bovine blood serum was used after sterilization through a Berkfeldt filter.

The first bacterial test organism experimented with was a 24-hour old culture of *Staphylococcus aureus* incubated at 37° C.; later pyogenic cocci obtained directly from acne and pimples pus was cultured.

Intermittent sterilization of the culture media was carried out in an autoclave at 120° C. for half an hour on two or three successive days in individual test-tubes containing 15 cc. of heart infusion agar. After the agar was cooled to 45° C., the sterile blood was added together with one drop from a sterile hypodermic syringe containing a 24-hour old culture of the test organisms. The tubes were well shaken and quickly poured into previously sterilized, wrapped petri dishes.

The varying consistency of the test ointments and other preparations used made them awkward to handle, especially in the small quantities necessary for the

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