rhubarb are sterile or at least set seed poorly. Both peppermint and spearmint are drug plants whose taxonomic positions are not clear. It is essential in dealing with economic plants that the constituents derived from them shall be uniform as far as is possible. In the genus Aconitum (3), it has been shown that many of the so-called species and varieties are subject to considerable variation in both their chemistry and cytology. The establishment of a clonal type of plant would assure uniform progeny and chemical constituents. In the life history of certain known clones no variation has been observed.

In "Standardized Plant Names" (6), the conception of the clone is not considered. Yet Sparks Aconite is listed as "*Aconitum Napellus, Spark's Variety.*" In the A. Ph. A. Monograph on Aconite (7), Sparks Aconite is listed as *Aconitum Napellus* var. *Sparkii.* Both of these citations are errors since the plant was named after a man by the name of Sparks and one cannot permit the cutting of a letter of a name according to the rules of nomenclature.

It is suggested that, in the monographs of drug plants, the word clone be used to designate those plants which are propagated vegetatively from one single seedling. That it is necessary to relate this plant, as far as it has been ascertained, to its nearest species is well understood.

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"In almost everything, experience is more valuable than precept"—Quintillian

Drug Extraction. XXIII. The Extraction of Ipomea*

By William J. Husa† and Thomas J. Macek‡

As part of their study of the official resins Husa and Fehder (1) reported on the relative value of different menstrua in the extraction of ipomea. They found that alcohol was preferable to the alcohol-water (9:1) mixture recommended by the N. F. VI. In the present investigation a further study has been made on ipomea and a report is presented on the relative merits of different methods of extraction of the drug.

EXPERIMENTAL

Materials Used.—Ipomea, N. F., in moderately coarse (No. 40) powder obtained from two different sources was used. Drug *A* contained 20.51 per cent resin and 8.22 per cent moisture. Drug *B* contained 20.53 per cent resin and 8.54 per cent moisture. Alcohol was used as the menstruum.

Analytical Methods.—The resin content of ipomea was determined by a modified N. F. VI Assay Method (see Experiment 1). Resin determinations on liquids were made by the N. F. VI Method. Moisture was determined by the U. S. P. XI Method for drugs containing no constituents volatile at 100° C. To determine total extractive, an aliquot sample of liquid was evaporated to apparent dryness on a water bath, the residue treated with 2 cc. of absolute alcohol and again evaporated to dryness on a water bath; the residue was then heated in an oven at 100° C. until the weight was constant. The hygroscopic nature of the resin and residues necessitated the use of balance desiccators in the balance.

Experiment 1. Variation of Solvent in the N. F. VI Assay of Ipomea.—Since alcohol was found to be the better menstruum for the extraction of ipomea, the question arose as to whether the assay for resin content should be conducted according to the directions specified in the N. F. VI, wherein an alcohol-water (9:1) mixture is used as the extracting solvent, or whether alcohol should be employed instead. The following experiment was conducted to determine the efficiency of both alcohol and the alcohol-

* Presented before the Scientific Section, A. PH. A., Richmond meeting, 1940.

This paper is based on a thesis presented to the Graduate Council of the University of Florida by Thomas J. Macek, in partial fulfilment of the requirements for the degree of Master of Science in Pharmacy.

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water mixture in extracting resin from ipomea following the assay procedure of the N. F. VI.

Four 10-Gm. samples of drug from source *A* were subjected to the N. F. VI assay for ipomea. Two of these were extracted with alcohol while the remaining two were treated with the alcohol-water menstruum. Four 10-Gm. samples of drug from source *B* were subjected to an identical treatment. Two 20-cc. aliquots were removed at 20° C. from each of the liquid percolates for determination of resin. Total extractive was likewise determined.

Table I expresses the results of the determinations in terms of per cent. Each figure represents the average of four separate determinations.

Table I.—Variation of Solvent in N. F. VI Assay

	Alcohol Used	
	Per Cent Resin	Per Cent T. E.[a]
Drug *A*	20.51	23.93
Drug *B*	20.53	24.29
	Alcohol-Water Used	
	Per Cent Resin	Per Cent T. E.[a]
Drug *A*	20.41	27.14
Drug *B*	20.35	27.76

[a] = Total Extractive.

Experiment 2. Maceration with an Excess of Alcohol.—An experiment was conducted to determine the time necessary for the establishment of equilibrium in the maceration of ipomea with an excess of alcohol, using the centrifuge method developed by Husa and Magid (2).

Into each tared, wide-mouth bottle of about 250-cc. capacity were placed 10 Gm. of drug and 90 Gm. of alcohol. The bottles were then placed in a cabinet at 23° to 26° C. for 15 minutes, during which time the bottles were shaken every 5 minutes. The bottles were then centrifuged at about 1000 r. p. m. for 10 minutes and allowed to stand 5 minutes. The clear supernatant liquid was decanted into tared, glass-stoppered bottles and weighed; the bottles containing the wet marc were also weighed. The macerate was adjusted to 20° C. before withdrawing samples for assay. The same technique was employed for 12-hour, 24-hour and 36-hour maceration periods except that the bottles were shaken at convenient irregular intervals. Drug from both sources was used in the experiment.

Calculations were made as follows: (Weight of drug taken for extraction) minus (weight of moisture in drug) minus (weight of total extractive in macerate) = (weight of dry marc). (Weight of wet marc) minus (weight of dry marc) = (weight of liquid imbibed by the marc). The loss of menstruum during the process was determined by comparing the total weights of the materials used with the combined weights of the macerate and wet marc.

The results in Table II are averages of duplicate assays of duplicate macerations.

Assuming that the liquid imbibed in the marc contained the same concentration of dissolved resin as the macerate, calculations were made to determine the distribution of the resin at different stages of the maceration. The results are given in Table III.

Table II.—Maceration with an Excess of Alcoho

Period of Maceration	Weight in Gm. of: Liquid Imbibed in Marc	Macerate	Total Extractive in Macerate	Resin in Macerate
Drug A				
15 min.	16.23	75.75	1.67	1.54
12 hr.	15.19	76.85	1.76	1.62
24 hr.	15.07	77.08	1.83	1.67
36 hr.	15.28	76.98	1.83	1.67
Drug B				
15 min.	12.25	79.57	1.64	1.46
12 hr.	12.45	79.85	1.81	1.60
24 hr.	12.48	79.82	1.84	1.66
36 hr.	12.78	79.56	1.83	1.68

Table III.—Distribution of Resin in Maceration with an Excess of Alcohol

Period of Maceration	Percentage of Resin: In Liquid Imbibed in Marc	In Macerate	Left Undissolved in Marc
Drug A			
15 min.	16.38	74.84	8.78
12 hr.	15.99	78.98	5.03
24 hr.	16.28	81.23	2.49
36 hr.	16.58	81.08	2.34
Drug B			
15 min.	11.20	71.31	17.49
12 hr.	12.42	77.93	9.65
24 hr.	12.95	80.76	6.29
36 hr.	13.49	82.02	4.49

Experiment 3. Percolation.—Four percolators were used in this experiment. Three were cylindrical in shape, of Pyrex glass, 64 cm. in length and 4 cm. in internal diameter. The fourth percolator consisted of an ordinary glass, ribbed funnel of about 1-liter capacity. All were fitted with tubing and clamps for adjusting the rate of flow of percolate. The drug used throughout the experiment was from source *A* and 250 Gm. of it were used in each percolator.

Two of the cylindrical percolators were packed dry, the drug being introduced in small portions with slight agitation to promote even distribution, and when the entire portion had been introduced pressure was applied to the drug from the top. One of these percolators (Percolator 1) was packed very firmly from the top and the volume in the percolator occupied by the packed drug was 585 cc. The second percolator (Percolator 2) was packed less firmly and the volume occupied by the packed drug in this case was 625 cc. The third percolator (Percolator 3) and the funnel (Percolator *F*) were packed with drug previously moistened with 25 cc. of alcohol for each 100 Gm. of drug; pressure was applied to the top of the drug. The volume occupied by the drug in Percolator 3 was 600 cc. while in Percolator *F* it was 550 cc.

The menstruum was added to each of the percolators and when liquid reached the lower orifice the

flow was stopped for a maceration period of 24 hours. Percolation was then allowed to proceed so that percolate was delivered at the rate of about 10 drops per minute. A total of 750 cc. of percolate was collected from each 250 Gm. of drug in successive fractions of 125 cc., 125 cc., 250 cc. and 250 cc.

The time required for liquid to reach the lower orifice of each percolator was as follows: Percolator 1 (dry-packed), 261 minutes; Percolator 2 (dry-packed), 216 minutes; Percolator 3 (moist-packed), 140 minutes; Percolator *F* (moist-packed), 15 minutes.

The results of resin and total extractive determinations are expressed in Table IV.

Table IV.—Percolation of Ipomea

Fraction	In Percolate from Percolator 1	2	3	*F*
	Resin Extracted in Gm.			
1 (125 cc.)	32.00	31.00	33.98	33.93
2 (125 cc.)	17.63	17.88	14.00	12.75
3 (250 cc.)	1.25	1.19	1.15	2.01
4 (250 cc.)	0.25	0.29	0.30	0.43
Total (750 cc.)	51.13	50.36	49.43	49.12
	Percentage of Resin Extracted			
1 (125 cc.)	62.40	60.45	66.26	66.11
2 (125 cc.)	34.38	34.86	27.30	24.86
3 (250 cc.)	2.44	2.31	2.24	3.92
4 (250 cc.)	0.48	0.56	0.58	0.83
Total (750 cc.)	99.70	98.18	96.38	95.72
	Total Extractive in Gm.			
1 (125 cc.)	34.13	34.75	37.65	37.88
2 (125 cc.)	20.25	20.13	15.70	14.30
3 (250 cc.)	2.09	1.71	1.64	3.15
4 (250 cc.)	0.69	0.69	0.71	0.89
Total (750 cc.)	57.16	57.28	55.70	56.22

Experiment 4. Forced Percolation through a Long Column of Drug.—Using Drug *A*, tests were conducted to determine the efficiency of extraction of ipomea by the method of forced percolation through a long column of drug. The apparatus previously described by Husa and Huyck (3) was employed. A long drug column (approximately 24 feet) was obtained by using six sections of tubes and six elbows all of flanged pipe made from Pyrex glass. When erected the apparatus stood vertically about four feet in height and each straight tube was attached to the next by means of the elbow. The dimensions of the tubes were as follows: length, 91 cm.; internal diameter, 2.5 cm.; thickness of wall, 0.5 cm.

The six tubes and elbows were packed with a total of 2000 Gm. of drug, moistened with a total of 500 cc. of alcohol. The moistened drug was packed into the apparatus with firm pressure using about 30 to 40 Gm. of drug for each packing portion. The volume occupied by the drug in the apparatus was approximately 4000 cc. The drug-filled tubes and elbows were joined together using interface joint gaskets made of sulfur-free gum rubber and held together by metal joint flanges. One end of the drug column was connected to a pressure tank containing 6000 cc. of the menstruum. The menstruum was forced through the drug with air pressure that was maintained at 5 to 6 lb. per sq. in. throughout the experiment. The percolate was collected in two fractions, each 1000 cc. in volume. Resin and total extractive determinations were made on these fractions. The entire experiment was repeated in exactly the same manner. The only variation noted between the two experiments was in the time required for the menstruum to pass through the column of drug and reach the orifice. In the first experiment this required 111 hours while in the second experiment 178 hours were necessary. The results are expressed in Table V.

Table V.—Forced Percolation through Long Column of Drug

A. Experimental Data

Experiment	Volume in Cc.	Gm. Resin	Gm. T. E.[a]
	Fraction I		
1	1000	292.5	316.5
2	1000	291.5	316.0
	Fraction II		
1	1000	115.2	129.2
2	1000	117.0	131.2

B. Percentage of Resin Extracted

Fraction	Experiment 1	2
I[b]	71.3	71.1
II[b]	28.1	28.5
Total[c]	99.4	99.6

[a] = Total Extractive.
[b] = 0.5 cc. per Gm. of drug.
[c] = 1 cc. per Gm. of drug.

DISCUSSION OF RESULTS

Variation of Solvent in the N. F. VI Assay of Ipomea.—The data in Table I indicate that assay for resin content of ipomea by the procedure outlined in the N. F. VI but using alcohol as the menstruum gives results slightly higher than when the N. F. VI menstruum (9 volumes alcohol–1 volume water) is employed. Within experimental error both menstrua may be considered equally efficient. In the present study alcohol was the menstruum used in the assays, since alcohol was the menstruum employed in the extraction operations. More total extractive is obtained with the N. F. VI menstruum than when alcohol alone is employed.

Maceration with an Excess of Alcohol.—The data in Tables II and III indicate that although the rate of extraction of resin from ipomea by macerating 10 Gm. of drug with 90 Gm. of alcohol may vary slightly with the source and sample of drug used, the

greater portion of the resin content can be dissolved from the drug in a 15-minute maceration period. The efficiency of extraction of resin increases slowly with increase in the duration of the maceration period so that at the end of 36 hours less than 5 per cent of the resin remains undissolved in the marc. In the case of ipomea, equilibrium is reached at the end of 24 hours of maceration.

In this respect ipomea varies somewhat with other drugs studied. Husa and Magid (2) showed that equilibrium in the extraction of alkaloids by maceration from belladonna root in Nos. 40, 60 and 80 powders was reached in 15 minutes. In the case of jalap, Husa and Fehder (4) found that equilibrium in the extraction of resin was reached within 15 minutes. On the other hand, Husa and Lee (5) attained equilibrium only after 36 hours of maceration of 10 Gm. of podophyllum with 90 Gm. of alcohol.

Extraction by Percolation.—The results in Table IV show that more than 95 per cent of the resin content of ipomea can be obtained in 750 cc. of percolate from 250 Gm. of drug. At least 90 per cent of the resin is found in that fraction of percolate numerically equal in cc. to the weight in Gm. of drug taken for extraction. Moistening of drug before packing is without notable advantage. Extraction of resin is more complete from drug packed tightly than from drug packed less tightly.

Forced Percolation through a Long Column of Drug.—Using the method of forced percolation through a long column of drug it was found that more than 99 per cent of the resin could be extracted in the first 1000 cc. of percolate from 1000 Gm. of drug. The air pressure employed for forcing the menstruum through the drug was maintained at 5 to 6 lb. per sq. in. throughout the extraction process. The moistened drug was packed in small successive portions with firm pressure.

Using the same apparatus, Husa and Huyck (3) obtained full-strength fluidextracts of belladonna root without resorting to the collection of various fractions of weak percolates. They employed a pressure of 25 to 35 lb. per sq. in. Husa and Lee (5) found that as much as 99 per cent of the resin of podophyllum could be extracted in the first 1000 cc. of percolate from 1000 Gm. of drug if the drug had been packed in small successive portions with moderate firmness; the extraction was less complete with looser packing and when breaks occurred in the drug column during percolation. They employed a maximum pressure of 30 lb. per sq. in.

SUMMARY

A comparative study was made of the extraction of ipomea by various methods. Alcohol was found as efficient as alcohol-water (9:1) in the N. F. VI assay for ipomea. In the process of maceration of ipomea with an excess of alcohol, the greater portion of resin was dissolved from the drug within 15 minutes. In percolation experiments at least 90 per cent of the total resin of the drug was obtained in 250 cc. of percolate from 250 Gm. of drug. More than 99 per cent of the resin was obtained in the first 1000 cc. of percolate from 1000 Gm. of drug using the method of forced percolation through a long column of drug.

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Hydrogenated Oil as an Ointment Base

IV. Antiseptic Ointments*

By Geroge W. Fiero and Ted A. Loomis†

Bacteriological methods have been used by many workers to determine the antiseptic value of ointments. Considerable work has been done on the antiseptic value of phenol ointment (1). Husa and Radin (2) reported that the activity of phenol ointment is de-

* Presented before the Section on Practical Pharmacy and Dispensing, A. PH. A., Richmond meeting, 1940.

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