

are not as numerous. Some of the trichomes of the native drug are but rudimentary appearing as mere papillae.

SUMMARY

<i>American Sample</i>	<i>Foreign Sample</i>
<i>Pollen</i> Large quantity	very scarce
<i>Trichomes</i>	
number—great	great
surface—very rough	less roughened
size—large and small in equal quantity	more large than small
cavity—small at base	large at base
papillae—on leaf surfaces and stem epidermis	few
<i>Leaf tissue</i> great amount	moderate quantities
<i>Mesophyll</i> bright green	brownish green
<i>Fibrovascular tissue</i> large in amount	small in amount

We must realize that the fragmentary notes here presented are open to review and enlargement. A complete treatment of the subject of *Cannabis sativa* would require investigation of the slight differences in botanical and histological structure not only of a few samples of the two drugs but of many specimens from as wide a range of territory as possible. If the materials for such a study were available we would undoubtedly find many minor differences resulting from climatic conditions.

COLUMBIA UNIVERSITY, COLLEGE OF PHARMACY.

THE CULTIVATION OF MEDICINAL PLANTS WITH OBSERVATION CONCERNING CANNABIS.*

L. E. SAYRE.

The Author dwells upon the importance of cultivation of medicinal plants in the United States. He has recently traveled in the South and refers to the advantages of Georgia's climate and soil for medicinal plant cultivation and the advantageous location of experiment stations of that State. The Author refers to some experimental work at Glenolden and states that despite contrary statements, *Cannabis* is an important and reliable drug.

One of the first experiments in the cultivation of medicinal plants in the United States on which the author was in position to make some personal observations was about the year 1887 when a friend of his (Mr. C. B. Allaire) had received through Dr. E. R. Squibb some genuine Trieste seed of the official fruit, colocynt. Mr. Allaire kindly asked the writer's co-operation in the experimental research—he to cultivate the plant (near Albuquerque), and the writer to make an analysis of the fruit product when it had matured. To the writer's surprise a barrel of this fruit was received which was nearly as large as a small water melon. This enormous size, it was found, was due to hybridization. Mr. Allaire had not taken the proper precaution to isolate the colocynt patch. It had been

*Read before Scientific Section, A. Ph. A., San Francisco meeting.

located too closely to a garden plat of water melons. On analysis, the fruit proved to be less bitter than the official fruit; proportionately diluted.

Since this time the writer has taken much interest in the cultivation of medicinal plants and while he has not done much in an agricultural way he has watched with intense concern the experimental work in the Bureau of Plant Industry in Washington and the individual efforts of others. Professor Schneider of San Francisco has reported his work in cultivating belladonna on an extensive scale. We have examined the leaves and roots of the plants from his field and found them remarkably rich in alkaloidal content. Our own native stramonium, without special cultivation, has been repeatedly examined and reported upon by us as furnishing the official alkaloidal requirement. It is needless to give further detail to show that the writer's interest is more than academic.

During the past summer the writer has had a splendid opportunity of making certain observations in connection with this subject which through the persuasion of a committee of this Section of the American Pharmaceutical Association, he has been induced to record in its proceedings, or in other words, to present a paper upon it.

It has been repeatedly stated, by various writers in our pharmaceutical journals, that now is the opportune time for a special effort to be made in this country to make itself, as far as possible, independent of foreign supply and to encourage home production of plants producing remedial agents.

During the past summer it has been the writer's privilege to study a section of the South which seems to him especially favorable for this purpose. I refer to the section included in an area which lies around and about Atlanta, Macon, and Savannah. Doubtless many other adjacent positions may be as favorable for the above purpose. Traveling through this district (mostly on wheels however) the writer has been very much impressed with the immense variety of plants, of different orders, growing wild there and of the splendid system of Georgia in distributing experimental farms at advantageous geographical intervals throughout the State. This system, in this section, if taken advantage of, in such a way as to include medicinal plants would doubtless lead to favorable economic results. In spite of all that has been said to discourage this enterprise in this country, it seems we should do something, as an Association to promote this growing need.

This idea receives substantial support when we observe, for instance, that one of our large manufacturing chemists, encouraged by former experimentation, in Philadelphia, has now under cultivation several acres of medicinal plants, such as belladonna, digitalis, hyoscyamus and cannabis. At Glenolden, Pa., the writer had the opportunity of seeing these fields of medicinal plants growing vigorously. Doubtless there are many other sections where this enterprise has been started and developed, and since this is the case, it would be wise for this Section of our Association to have a committee whose object it would be to collect statistics, to foster and promote the praiseworthy object, and to furnish reliable information as to possibilities in medicinal plant culture in this country. This information may be had for the asking and those who are engaged in this form of plant culture would be only too glad to contribute to the common fund of

information. The plea we would make, then, would be for a proper organization of promoting this work in the line above indicated.

In connection with the subject of plant culture, attention is naturally directed to the fact that there is a growing tendency to discard this class of plant remedial agents. Recently there was a circular letter sent out by the Council of Pharmacy and Chemistry of the American Medical Association, which urged the discontinuance of cannabis as a useful drug on account of its alleged variability in quality and uncertainty of action. On this point we wish to call attention to the fact that cannabis, (both the C. Indica and Americana) do not by physiological test give any greater variation than the other prominent potent drugs.

Quoting from reliable published statements we would cite the results of Pit-tenger (see his book Biochemic Drug Methods, page 6). Adding thereto we have the following instructive tables recording more recent unpublished results:

The following table shows the comparative results of both the physiologic and chemic assay of the three varieties of Cannabis:

TABLE NO. I.

CANNABIS INDICA		CANNABIS AFRICANA		CANNABIS AMERICANA	
Chemical Assay	Phys. Assay	Chemical Assay	Phys. Assay	Chemical Assay	Phys. Assay
12.2% resin		10.6% resin	100%	6.4% resin	133%
12.7% resin		16.7% resin	133%	14.4% resin	100%
14.2% resin	100%	14.2% resin	133%	14.1% resin	100%
12.8% resin	100%	8.6% resin	100%	8.5% resin	114%
13.0% resin	80%	10. % resin	133%	10.8% resin	260%
13.4% resin	66%	17.5% resin	20%	8.5% resin	200%
98.7% resin	125%	18.8% resin	100%		133%
	200%	17.8% resin	83%		133%
	266%		209%		
13.2% resin	133%			16.2% resin	200%
94.6% resin	166%				200%
12.0% resin	200%				100%
	133%				133%
	133%			16.8% resin	133%
13.0% resin	133%				80%
	133%				150%
	220%				133%
	160%				200%
	80%				66%
12.0% resin	400%				200%
12.0% resin	400%				90%
11.4% resin	100%				160%
9.9% resin	125%				100%
					133%
				10.8% resin	200%
				10.8% resin	260%
				8.5% resin	114%

TABLE NO. II.

Drug	Number of Samples Assayed	Variation Percentage
Digitalis tincture	51	30 to 444
Ergot fluidextract	17	0 to 310
Aconite leaves tincture	6	38 to 111
Aconite root tincture	12	33 to 363
Cannabis indica fluidextract	15	40 to 150
Gelsemium tincture	7	64 to 156
Strophanthus tincture	12	55 to 277
Squill fluidextract	13	71 to 153

It can readily be seen therefore that while Digitalis varies in activities from 30 to 444% and Ergot from 0 to 310% the two tables show a variation in the Indian and American varieties of Cannabis of only 66 to 260%. There was only one sample of Cannabis which ran below 66% and that was of the African variety which is not very extensively used in this country.

Table No. 2, however, shows only the variation found in drugs which cannot be satisfactorily standardized chemically. It would be wise to include a table showing the variation found in drugs for which we have good chemical methods of assay.

The following table taken from the Proceedings of the Pennsylvania Pharmaceutical Association 1914, page 160, shows the results of 286 crude drug assays made by the same pharmacologist:

Drug	No. of Samples	Lowest Assay	Highest Assay	Average		Standard	Number Below Standard	Number Above Standard
Aconite leaf	1	0.362	0.362	0.362	0.2 %	Ether Sol. Alk.	1	0
Aconite root	8	0.297	0.784	0.490	0.5 %	Ether Sol. Alk.	4	4
Belladonna leaf	16	0.364	0.608	0.490	0.3 %	Mydriatic Alk.	16	0
Belladonna root	22	0.410	0.700	0.543	0.45%	Mydriatic Alk.	19	3
Calabar bean	7	0.079	0.130	0.109	0.15%	Ether Sol. Alk.	0	7
Cannabis Indica	1	13.0	13.0	13.0	10. %	Resin	1	0
Cantharides Russian	5	0.75	1.06	0.91	0.6 %	Cantharidin	5	0
Capsicum	15	13.0	18.0	16.0	10. %	Oleoresin	15	0
Cinchona yellow	10	5.29	9.13	6.69	5. %	Total Anhyd. Alk.	10	0
Cinchona red	14	6.83	10.18	8.35	5. %	Total Anhyd. Alk.	14	0
Coca leaf	10	0.594	1.15	0.846	0.5 %	Ether Sol. Alk.	10	0
Colchicum seed	6	0.52	1.00	0.687	0.45%	Colchicine	6	0
Conium	1	0.65	0.65	0.65	0.5 %	Coniine	1	0
Cubcbs	6	13.9	19.8	16.9	15. %	Oleoresin	5	1
Digitalis	1	0.356	0.356	0.356	0.25%	Digitoxin	1	0
Ergot	4	0.18	0.31	0.25	0.15%	Cornutine	4	0
Gelsemium	8	0.342	0.658	0.515	0.4 %	Alkaloids	7	1
Ginger African	3	8.50	9.61	9.00	6. %	Oleoresin	3	0
Ginger Jamaica	3	4.33	5.75	5.06	4. %	Oleoresin	3	0
Hyoxyamus	14	0.0382	0.110	0.0692	0.08%	Mydriatic Alk.	6	8
Hydrastis	2	3.22	3.42	3.32	2.5 %	Hydrastine	2	0
Ignatia	3	1.32	1.83	1.56	1.5 %	Total Alkaloids	2	1
Ipecac, whole	15	0.950	2.36	1.78	1.75%	Alkaloids	11	4
Ipecac, powder	8	1.34	2.52	2.14	1.75%	Alkaloids	7	1
Ipecac, dried	1	2.49	2.49	2.49	1.75%	Alkaloids	1	0
Jalap	13	5.07	9.24	6.62	7. %	Total resin	3	10
Kola nut, dried	9	1.09	1.78	1.42	1. %	Alkaloids	9	0
Lobelia	1	0.838	0.838	0.838	0.5 %	Alkaloids	1	0
Male Fern	4	6.85	10.12	8.23	6. %	Oleoresin	4	0
Nux Vomica	18	0.46	1.33	0.838	1.25%	Strychnine	2	16
Opium	6	10.13	11.78	11.05	9. %	Crys. morphine	6	0
Opium, powder	11	11.80	12.67	12.20	12-12.5 %	Crys. morphine	9	2
Pilocarpus	4	0.303	0.948	0.481	0.5 %	Alkaloids	3	1
Podophyllum	8	2.67	5.30	3.47	4. %	Resin	2	6
Sanguinaria	11	3.28	6.84	4.94	2.5 %	Alkaloids	11	0
Stramonium leaf	11	0.304	0.520	0.404	0.25%	Mydriatic Alk.	11	0
Veratrum	6	1.30	2.14	1.74	1. %	Alkaloids	6	0

It will be noted from the tables that,

- 16 samples of Belladonna leaf varied in strength from 121.0% to 200.0%.
- 22 samples of Belladonna root varied in strength from 91.1% to 155.5%.
- 10 samples of Cinchona yellow varied in strength from 105.8% to 182.6%.
- 14 samples of Cinchona red varied in strength from 136.6% to 203.0%.
- 10 samples of Coca leaf varied in strength from 118.8% to 230.0%.
- 6 samples of Colchicum seed varied in strength from 115.5% to 222.2%.
- 8 samples of Gelsemium varied in strength from 85.5% to 164.5%.
- 14 samples of Hyocyamus varied in strength from 47.7% to 137.5%.
- 15 samples of Ipecac, whole, varied in strength from 54.2% to 135.0%.
- 8 samples of Ipecac, powdered, varied in strength from 76.6% to 144.0%.
- 13 samples of Jalap varied in strength from 72.4% to 132.0%.
- 18 samples of Nux Vomica varied in strength from 36.8% to 106.4%.
- 4 samples of Pilocarpus varied in strength from 60.6% to 189.6%.
- 8 samples of Podophyllum varied in strength from 66.7% to 132.0%.
- 11 samples of Sanguinaria varied in strength from 131.2% to 273%.
- 11 samples of Stramonium leaf varied in strength from 121.6% to 208.0%.
- 6 samples of Veratrum varied in strength from 130.0% to 214.0%.

According to the tables, it would appear that *Cannabis sativa* is no more variable than many of the other drugs of the Pharmacopoeia.

A detailed outline of the methods which were employed for physiologically standardizing *Cannabis* and its preparations is given on pages 97 and 102 of the volume mentioned.

It is needless to say that any effort to discontinue a drug or remedial agent will be of little avail if that drug proves itself useful and important in the hands of physicians who obtain favorable clinical results from its use.

Drugs are sometimes useful to those only who know how and when to use them, and, those who have had favorable experience with them as "tools," in the treatment of disease cannot be dissuaded from their use by the mere dictum of any medical or pharmaceutical body.

A BIOLOGICAL TEST FOR ARSENIC.*

ALBERT SCIINEIDER.

The test for arsenic about to be described is not new as it has been used in Germany and other European countries for some time. It is, however, quite new to American laboratory workers and is hereby given for the benefit of those who are not familiar with it.

Arsenic is widely distributed in nature and is extensively used in the arts and industries. Medicinally it is a popular tonic and it is also much used as an insecticide in the form of sprays and washes. Animal hides are frequently preserved by arsenic, which accounts for the presence of this powerful poison in glues and gelatins made from such hides. Fruits and vegetables which have been sprayed with arsenical compounds for the purpose of destroying insect pests, may contain enough of this substance to produce symptoms of poisoning. Arsenic is occasionally added to alcoholic beverages to give them a tonic effect. It has been demonstrated that very minute amounts of arsenic are normally present in various organs of the human body, as the thyroid gland, the thymus

* Presented in Scientific Section A. Ph. A., San Francisco meeting.