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ABSTRACT OF DISCUSSION.

J. C. Krantz Jr., inquired whether Dr. Zeigler has used the instrument in standardizing any pharmaceutical preparations and then checked results.

The author replied that he had not done any research work with the administration of drugs, but expected to take this up later.

Dr. H. C. Wood said he was very much interested in the apparatus and wondered whether Dr. Zeigler had attempted to demonstrate the comparative changes under the influence, for example, of drugs by simultaneous comparison with mercury and the oscillometer.

Dr. Zeigler replied that he had not, but hoped to make a report on this phase later.

Dr. A. Schneider said that he would like to try this instrument out to see whether it is more delicate than the so-called lie detector which has been employed by Dr. Larson for some years. He asked the author of the paper where the instrument can be purchased. The reply was made that the instrument was of French manufacture, and that Arthur Thomas and Company, of Philadelphia, were the agents.

Dr. H. C. Wood referred to the paper on "The Intraperitoneal Injection of Certain Drugs," and asked why "it was practically impossible to penetrate the intestines with the needle used?"

Dr. Zeigler replied that the short, curved needle and the position of the subject made it almost impossible to penetrate the intestines; the subject being on its back, there is quite a space between the intestines and the peritoneum. In reply to the request in regard to the technic used in debarking dogs, he replied that a bronchoscope made by using a large piece of brass tubing was used; the vocal chords were clipped with an instrument for this purpose.

A PHARMACODYNAMIC STUDY OF THE ANTHELMINTIC PROPERTIES OF TWO OILS OF CHENOPODIUM.

BY A. RICHARD BLISS, JR.

INTRODUCTION.

These investigations were prompted by the facts that (1) the supply of oil of Chenopodium "American Oil of Wormseed" is inadequate for human and animal medication, and (2) the resulting high price of the "Maryland Oil of Chenopodium" is consequently preventing the extensive use of the drug in the treatment of domestic animals, a field in which it is much needed.¹

In 1854 an article by Garrigues² described the Southern (U. S.) and the Western (U. S.) Chenopodium plants, and accredited the oils distilled from both varieties with equal anthelmintic properties. During the same year, very shortly after the appearance of this article, another paper³ was published by a second writer protesting

against Garrigues' statements concerning the efficacy of the oil distilled from the Western plants ("Western Oil of Chenopodium"), but offering no proofs of the superiority of the oil distilled from the Southern plants ("Maryland, Baltimore, or Southern Oil of Chenopodium").

The second article referred to above is probably responsible for the generally accepted opinion that Oil of Chenopodium, conforming to the requirements of the United States Pharmacopœia,⁴ can be produced only from *Chenopodium ambrosioides*, var. *anthelminticum* cultivated in Carroll County, Maryland. The work of Wirth⁵ on an oil distilled from plants grown at the University of Michigan Botanical Gardens apparently substantiated this opinion. The conclusion of Wirth and others, that the inferiority of the Western Oil of Chenopodium was due to a low Ascaridol content, was apparently based entirely upon the low specific gravity of the Western Oil they had obtained.

Schimmel's reports⁶ indicate that Ascaridol, which apparently corresponds to the heavier fraction obtained in the distillation of Oil of Chenopodium, is the part responsible for the anthelmintic properties of the drug. Although this statement has not been proved and no reasons for the conclusion have been stated, it has been generally accepted. Hall and Hamilton⁷ demonstrated that although Ascaridol is anthelmintic, it is also a very active gastro-intestinal irritant; while the lighter fraction of the oil is more anthelmintic and decidedly less irritating. Salant and Nelson⁸ found Ascaridol 30% more toxic than Oil of Chenopodium.

The reports of Schimmel⁹ and the investigations of Nelson¹⁰ and of Russell¹¹ indicate that the failure of Wirth and other workers to obtain a satisfactory oil from plants cultivated in the Middle West was probably due to the faulty methods of distillation employed. Konantz¹² work substantiates the foregoing statement, for the oils prepared by him from Chenopodium plants cultivated in the Middle West meet the U. S. Pharmacopœial specifications.

Although a considerable number of pharmacodynamic investigations of the anthelmintic properties of Oil of Chenopodium ("Maryland Oil") have been carried out (particularly by Hall, Hamilton, Widgor, Foster, Wilson, and Salant and co-workers), and while it is probably true that some of the oils used in these investigations were admixtures of the Maryland and the Western Oils, up to the present time no pharmacodynamic studies had been made of the pure, unmixed Western Oil or of the oil distilled from the Wild Chenopodium of the Middle Western States.

MATERIALS AND METHOD.

The writer's pharmacodynamic investigations were carried out on three samples of Oil of Chenopodium distilled by Konantz.¹³ One of the samples was an oil (S/G 0.966*) distilled from plants which had been shipped from Carroll County, Maryland (referred to in this study as "Maryland Oil of Chenopodium"); a second was a sample of an oil (S/G 0.970) distilled from plants cultivated in Adams County, Illinois (called "Western Oil of Chenopodium" in this article); and the third was a sample of an oil (S/G 0.964) derived from cultivated, wild, wormseed plants found in Adams County, Illinois (the "Wild Western Oil of Chenopodium" hereafter referred to).

* U. S. P. IX requirement: 0.955 to 0.980.

Because of the fact that Oil of Chenopodium in single therapeutic dose has a decidedly higher efficacy against ascarids than is shown by any other anthelmintic, the common ascarid of the dog was used as the test worm in determining the anthelmintic values of the three oils studied. Other varieties of worms found in the experimental animals were disregarded. Hall and Foster,¹⁴ and Hall^{15,16} established the superiority of Oil of Chenopodium as an ascaricide in dogs. Their results showed that the oil has no equal for the removal of ascarids, since it will, in the vast majority of cases, remove 100% of these worms present in the dog. Clinical observations have shown that the oil is apparently about as effective, when properly administered, against ascarids in man. Hall and Foster¹⁷ experimentally established its efficacy against ascarids in swine; Hall, Wilson and Wigdor¹⁸ in the horse; and Hall¹⁹ in the cat.

The method employed by the writer was that of Hall and Foster,²⁰—*i. e.*, the collection of all worms from the feces after the treatment and from the dog post-mortem. The standard dose of Oil of Chenopodium used throughout the investigations was 0.1 mil per Kilo, the amount conclusively established by Hall²¹ as being capable of removing all ascarids from the dog in the great majority of cases. The apparatus employed was that advocated by Hall²² for examining feces for evidences of parasitism. The oils were administered in soft, elastic capsules²³ according to the practical dosage recommended by Hall,²⁴ *viz.*, 5 minims for dogs weighing 10 pounds or less; 10 minims for dogs weighing 10 to 20 pounds; 15 minims for dogs weighing 20 to 30 pounds; not to exceed 20 minims for dogs weighing over 30 pounds. One fluidounce (30 mils) of Castor Oil was given immediately after the Oil of Chenopodium. The investigations of Hall and Wigdor,^{25,26} and Hall and Hamilton²⁷ indicate that the administration of Castor Oil immediately after the Oil of Chenopodium is of extreme importance, since it is protective and not merely purgative. Oil of Chenopodium is decidedly poisonous, constipating, and a gastro-intestinal irritant. Castor Oil retards the absorption of the Oil of Chenopodium, distributes it over a larger surface of the gastro-intestinal mucosa, and promotes elimination. The observations of the writer substantiate the foregoing statements. Salant and Nelson²⁸ also demonstrated that certain fixed oils are of value in preventing poisoning by Oil of Chenopodium.

Each experimental dog, housed in a separate, thoroughly cleaned cage, was given no solid food for 24 hours. Early the following morning the Oil of Chenopodium and the Castor Oil were administered. No food was given for at least three hours after the drugs. All feces passed during the following five days were carefully examined for ascarids. At the end of the fifth day the animal was killed (shot), and the alimentary tract from the esophagus to anus was slit and examined for ascarids and lesions.

The results of the study are tabulated in Tables I, II, III, and IV.

SUMMARY.

In Table I there are 24 dogs with a total of 267 ascarids; an average of 11 + per dog. Of these worms the treatment with the Western Oil of Chenopodium removed 263. The treatment was, therefore, 98.50% effective against ascarids, a value extremely close to the mathematical average efficacy in Note 1, Table I.

There are 18 dogs in Table II with a total of 161 ascarids; an average of 9—

TABLE I.—WESTERN OIL OF CHENOPODIUM.

No.	Dog no.	Wt. in Kilos.	Oil Chen. in minims.	Castor Oil in mils.	No. ascarids in stools.	No. ascarids post-mortem.	Digest tract.	Efficacy against ascarids.	No.
1	1	10	15	30	6	0	N.*	100%	1
2	2	13	15	30	10	0	N.	100%	2
3	3	13	15	30	7	0	N.	100%	3
4	6	16	20	30	9	0	N.	100%	4
5	7	15	20	30	18	0	N.	100%	5
6	9	6	10	30	11	0	N.	100%	6
7	10	12	15	30	4	0	N.	100%	7
8	11	11.5	15	30	7	1	N.	87.5%	8
9	14	8	10	30	21	0	N.	100%	9
10	15	14	15	30	2	0	N.	100%	10
11	16	14.5	20	30	8	0	N.	100%	11
12	19	7.5	10	30	2	0	N.	100%	12
13	21	12	15	30	9	1	N.	90%	13
14	23	14.5	20	30	14	0	S. I. ¹	100%	14
15	24	15	20	30	35	0	N.	100%	15
16	25	15	20	30	1	0	S. I. ¹	100%	16
17	27	12	15	30	23	0	N.	100%	17
18	29	9	10	30	8	0	N.	100%	18
19	31	15	20	30	6	0	N.	100%	19
20	32	9.5	10	30	2	0	N.	100%	20
21	33	12	15	30	10	2	N.	83%	21
22	35	16	20	30	29	0	S. I. ¹	100%	22
23	38	6	10	30	5	0	N.	100%	23
24	39	8	10	30	16	0	N.	100%	24

Note 1: Average efficacy against ascarids, 98.35%.

Note 2: Percentage showing slight inflammation, 12.5%.

* Abbreviation N. for normal.

¹ Abbreviation S. I. for slight inflammation.

TABLE II.—WILD WESTERN OIL OF CHENOPODIUM.

No.	Dog no.	Wt. in Kilos.	Oil Chen. in minims.	Castor Oil in mils.	No. ascarids in stools.	No. ascarids post-mortem.	Digest tract.	Efficacy against ascarids.	No.
1	42	6	10	30	2	0	N.*	100%	1
2	43	7.75	10	30	8	0	N.	100%	2
3	44	10	15	30	3	0	N.	100%	3
4	45	16	20	30	18	2	S. I. ¹	90%	4
5	48	15	20	30	4	0	N.	100%	5
6	51	9	10	30	16	0	N.	100%	6
7	52	10.5	15	30	26	2	N.	93%	7
8	54	11.5	15	30	11	0	N.	100%	8
9	55	16	20	30	4	0	S. I.	100%	9
10	56	17	20	30	1	0	N.	100%	10
11	59	6.5	10	30	8	0	N.	100%	11
12	62	6.75	10	30	2	0	N.	100%	12
13	64	9.5	10	30	1	0	N.	100%	13
14	67	10	15	30	20	0	S. I.	100%	14
15	68	4.5	5	30	6	0	N.	100%	15
16	69	6	10	30	5	0	N.	100%	16
17	71	13.5	15	30	8	2	N.	80%	17
18	72	12	15	30	12	0	N.	100%	18

Note 1: Average efficacy against ascarids, 97.77%.

Note 2: Percentage showing slight inflammation, 16.66%.

* Abbreviation N for normal.

¹ Abbreviation S. I. for slight inflammation.

TABLE III.—MARYLAND OIL OF CHENOPODIUM.

No.	Dog no.	Wt. in Kilos.	Oil Chen. in minims.	Castor Oil in mills.	No. ascarids in stools.	No. ascarids post-mortem.	Digest tract.	Efficacy against ascarids.	No.
1	73	12	15	30	22	0	N.*	100%	1
2	74	15	20	30	12	0	S. I. ¹	100%	2
3	77	6	10	30	3	0	N.	100%	3
4	79	7.5	10	30	5	0	N.	100%	4
5	80	8.5	10	30	16	0	N.	100%	5
6	81	10	15	30	8	0	N.	100%	6
7	82	16	20	30	6	0	S. I.	100%	7
8	84	15.5	20	30	1	0	N.	100%	8
9	86	14.5	20	30	16	2	S. I.	90%	9
10	87	9	10	30	2	0	N.	100%	10
11	88	8	10	30	9	0	N.	100%	11
12	90	12.5	15	30	6	0	N.	100%	12
13	91	11.75	15	30	8	2	N.	80%	13
14	92	6	10	30	3	0	N.	100%	14
15	94	7	10	30	8	0	N.	100%	15
16	95	10	15	30	9	0	N.	100%	16
17	96	13.5	15	30	19	0	N.	100%	17
18	98	7.5	10	30	3	0	N.	100%	18
19	102	12	15	30	2	0	N.	100%	19
20	104	15	20	30	30	0	N.	100%	20

Note 1: Average efficacy against ascarids, 98.5%.

Note 2: Percentage showing slight inflammation, 15%.

* Abbreviation N. for normal.

¹ Abbreviation S. I. for slight inflammation.

TABLE IV.

No.	Oil.	No. of dogs.	No. ascarids in stools.	No. ascarids post-mortem.	Per cent. efficacy.	No.
1	Western Oil	24	263	4	98.50	1
2	Wild Western Oil	18	155	6	96.27	2
3	Maryland Oil	20	188	4	97.91	3

per dog. The treatment with the Wild Western Oil of Chenopodium removed 155 worms, and was, therefore, 96.27% effective, which is a little less than the mathematical average efficacy in Note 1, Table II.

Table III shows 20 dogs with a total of 192 ascarids; an average of 9.6 per dog. The Maryland Oil of Chenopodium treatment removed 188 of the parasites, and was consequently 97.91% effective, a small fraction less than the mathematical average efficacy in Note 1, Table III.

The foregoing figures are tabulated in Table IV.

The average efficacy of the three samples of oil was, therefore, 97.56%.

Examination of the digestive tracts of the animals showed a slight degree of inflammation in three dogs of each of the three series, or a total of 9 animals out of 62. This small percentage (14.5%) and the very mild degree of inflammation found indicates that this possible phase of the action of the Oils of Chenopodium in the dosage employed, may be disregarded in the cases of all three oils unless the animal already shows a gastro-enteritis. It is interesting to note that practically all the cases showing inflammation were among the heavier dogs which had received a larger dose of the oil. The reader is referred to Hall's study²⁹ of the lesions due to agents used in killing experimental dogs in anthelmintic investigations.

CONCLUSIONS.

This study has shown that Oil of *Chenopodium* properly distilled from plants cultivated in the Middle Western States is as efficacious in dogs against ascarids as the Maryland Oil of *Chenopodium*. On the basis of the experiments with dogs the writer ventures to state that these findings apply also to man.

The writer is indebted to Doctor W. A. Konantz of Quincy, Ill., for the samples of the oils used in this study; and also to Miss Pearl Waddell, A.B., and to C. H. Menge, A.B., for valuable technical assistance rendered during the investigations.

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THE MERRITT MISBRANDING BILL.

Representatives of drug manufacturing interests are circulating protests against the Merritt Misbranding Bill in the belief that the bill would apply to drugs and insecticides. They do not think that these commodities,

which are regulated, respectively, under the food and drugs act and the insecticide act, should be made subject to jurisdiction of the Federal Trade Commission under the Merritt Bill. However, it is doubted that this measure will be enacted by this Congress.