

The Laxative Activity in Mice of the Various Parts of the Senna Plant*

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Using a standardized procedure previously reported for determining the laxative activity in mice of senna, the laxative potency of various grades and kinds of commercial Tinnevely and Alexandria senna leaves and Tinnevely senna pods have been found to be reasonably uniform, the variations in potency not exceeding 25 per cent of the mean. Tinnevely senna was successfully grown to maturity in Chattanooga, Tenn., as well as on a larger scale in the Imperial Valley of California. The leaves and pods of such experimentally grown senna plants were found to have approximately the same potency as those from India or Egypt. The petioles were found to possess about 75 per cent of this potency while the stems and roots had only 50 per cent.

TINNEVELLY SENNA, which is produced from extensive cultivation of *Cassia angustifolia* Vahl in southern India, has been successfully grown to maturity in Chattanooga, Tenn., Valdosta, Ga., and in the Imperial Valley of California. These experimental growths of a botanical drug which is used in such great annual tonnage were prompted by the rapidly diminishing supply in the warehouses in this country during World War II.

Some of the difficulties of growing Tinnevely senna in this country are worth reporting at this time. The first trial planting of seed from commercially obtained pods failed to germinate. A small supply of viable seed was finally obtained from freshly imported pods by Dr. E. N. Gathercoal, Emeritus Professor of Pharmacognosy, University of Illinois. Later a quantity adequate for several experimental plantings was secured by salvaging seed from the waste obtained in commercial cleaning of senna leaflets. However, the germination of these seeds was poor. Experimental plots of the drug were planted in Chattanooga, and at Valdosta, Ga., in 1943 and again in 1947, under the direction of Mr. Elsworth Brown of our staff. Larger plots were planted under the direction of Dr. Gathercoal in the Imperial Valley of California in 1943 and following years.

EXPERIMENTAL

The plant matured about ninety days after planting, but was found in Chattanooga to be completely "winter killed" when exposed to a temperature slightly below 50° F. for even one night (1). A temperature of 45-48° F. caused the leaves to turn brown and drop off, and the entire plant to die quickly thereafter. Since the active principles of

the senna leaves are soluble in water, it is desirable that there be little rainfall during the season of approaching maturity of the plant. Examination of the weather records by Dr. Gathercoal revealed that the Imperial Valley was the most suitable place in the United States where these conditions could be expected. A seed supply sufficient to plant six acres was finally built up by harvesting seed from the experimentally grown material.

The California- and Tennessee-grown senna closely conformed to typical color characteristics, but that from Valdosta in southern Georgia was mildewed and otherwise discolored by rain at harvest time, and hence disqualified for our studies.

Rail freight rates from California to the eastern part of the United States exceed transportation by boat from India or Egypt. This expense added to higher labor makes the cost of delivered senna a few cents more per pound than the normal peacetime price.

Since we had available the entire senna plant of domestic growth, it seemed interesting and feasible to evaluate the relative laxative effect of the leaflets, pods, petioles, stems, and roots, as well as to compare these with the commercially available material. According to our standardized method of assay (2), the finely ground drug was suspended in boiling distilled water and 0.5-cc. doses were administered to mice by stomach tube. The results were considered positive if the feces were softened sufficiently to stain the underside of newsprint paper, and negative if no stain was visible. Our reference standard was from a lot of senna which had been selected several years ago for good green color and representative laxative action. The results are shown in Table I.

Our work seems to confirm the literature reports (3) in regard to the relative activity of the leaflets and the pods, which may vary from 70 to 115% of the senna selected as our standard for activity. This same range of activity is covered by different samples of leaflets, consequently the pods may be equal in strength to some leaflets, stronger or weaker than some other leaflets. With the domestically grown Tinnevely pods, we would conclude that the pods are slightly more active than the leaflets, the petioles about 75% as active, whereas the stems were 50% as active, and the roots 55% as active as the leaflets.

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TABLE I.—LAXATIVE ACTIVITY IN MICE OF VARIOUS PARTS OF THE TINNEVELLY SENNA PLANT

	M. L. D. ₅₀ Sample, ^{a, b} Mg./Mouse	M. L. D. ₅₀ Standard, ^c Mg./Mouse	Standard Senna Activity, %	Relative Strength of Parts of the Plant
California grown, 1943				
Leaflets	5.4	6.2	115	100
Petioles	8.7	7.2	83	71
Stems	20.4	7.5	37	31
Chattanooga grown, 1943				
Leaflets	7.5	6.1	81	100
Pods	<5.0	<6.3	100+	100+
Petioles	7.2	5.9	82	100
Roots	12.9	6.0	46	57
Chattanooga grown, 1947				
Leaflets	8.7	7.1	82	100
Pods	7.6	8.2	108	130
Petioles	14.2	7.4	52	63
Stems	13.5	7.4	56	68
Tuticorin grown, 1949				
Pods	8.1	5.7	70	...
Imported, stored in Chattanooga 8+ years				
Pods with seeds	9.8	6.9	70	...
Pods with seeds removed	9.2	6.9	75	...

^a M. L. D.₅₀ = Calculated minimum laxative dose in 50% of the mice tested. Three-dose assay, run for three days.

^b Total number of mice per dose of sample was between 50 and 75.

^c Total number of mice per dose of standard senna was 30.

In our storeroom we found a box of Tinnevelly pods which was known to have been there for eight years. These pods were tested both with and without the seed. With seed in the pod they showed 70% of standard activity and with the seed removed they showed 75% of the standard activity. By way of comparison, a sample of good green Tinnevelly pods which had been collected in Tuticorin in the summer of 1949¹ showed only 70% of standard senna activity. It appears, therefore, that pods after several years' storage are still an effective laxative.

SUMMARY

1. Tinnevelly senna can be successfully grown to maturity in the Imperial Valley of California and with some risk in other parts of the southern United States. The plant is quickly killed by a temperature drop below 50° F.

2. The leaflets and pods of domestically grown Tinnevelly senna plants have approximately the

same laxative potency as those commercially obtained from India and Egypt, and do not differ widely in activity when grown in Tennessee or California.

3. The leaflets and pods of domestically grown Tinnevelly senna are approximately equal in potency, the pods appearing slightly stronger.

4. The petioles of experimentally grown senna are approximately 75 per cent as active as the leaflets from the same plant, the stems and roots are 50 per cent and 55 per cent, respectively.

5. Commercial senna pods, as we have previously reported for the leaves, do not show marked loss of activity upon storage for several years.

REFERENCES

- (1) Gathercoal, E. N., "American Grown Senna, 1944," unpublished economic report in the Research Library of the Chattanooga Medicine Company, Chattanooga, Tenn.
- (2) Grote, I. W., and Woods, M., *THIS JOURNAL*, **33**, 266(1944).
- (3) Osol, A., and Farrar, G. E., Jr., "The Dispensatory of the United States of America," 24th ed., 1943, p. 1024.

¹ Kindly supplied by W. J. Bott, S. B. Penick & Company, New York, N. Y.