PALTHÉ SENNA AS AN ADULTERANT OF INDIAN SENNA LEAVES

By J. L. Forsdike

Received September 27, 1948

During recent months, a considerable quantity of Indian senna leaves adulterated with a foreign leaf has been offered for sale in this country. This adulteration has ranged from 5 to 10 per cent. in better quality leaves to upwards of 90 per cent. in some cheaper samples. The adulterant has been identified, by comparison with authentic specimens from the Herbarium of the Pharmaceutical Society of Great Britain, as the leaf of *Cassia auriculata* Linn., commonly known as Palthé Senna. The substitution of this leaf for senna has been previously reported[1], a colour reaction for its detection has been suggested by Vamossy[2] and some description of the leaves is given in Thoms' Handbuch[3] and by Wasicky[4]. However, since this adulteration appears to be occurring on a somewhat extensive scale, it was thought that some more detailed investigation, particularly of the anatomy of Palthé senna might be of value.

Material

The following description is based on leaflets taken from two sheets in the Herbarium of the Pharmaceutical Society of Great Britain marked: —

(1) Cassia auriculata, Deccan. Dr. T. Cooke

(2) Cassia auriculata, January, 1888. Rajputana. Coll. J. G. Prebble,

and on leaflets picked out from nine commercial samples, offered for sale as Tinnevelly senna.

Macroscopical Characters

The leaflets are oblong or obovate and generally smaller than those of genuine senna, being 8 to 30 mm. long and 4 to 15 mm. wide, yellowish to greyish-green, sometimes with a purple tinge; they are thin and brittle; the margin is entire; the apex blunt and mucronate and the base unequal, with a very short stalk (Fig. 1, A.). Both surfaces of the leaf bear numerous hairs, visible under a hand lens; the veins are more prominent on the under surface.

Microscopical Characters

Upper Epidermis. Polygonal prisms, with nearly straight anticlinal walls and a thin cuticle; many cells containing mucilage attached to the inner periclinal wall; this mucilage staining with ruthenium red. (Fig. 1, B, ep_1; C.) Stomata, 100 to 200 per sq. mm., sunk below the general epidermal level, rubiaceous, commonly having one subsidiary cell much larger than the other. (Fig. 1, B, C, st.) Trichomes 130 to 240 to 650 to 830 microns long and 14 to 22 microns wide, conical, unicellular, thick-walled, with a pointed apex and only very slightly warty cuticle. (Fig. 1, B, D, t.)

Lower Epidermis. Similar to the upper, except that the cells are generally rather smaller, the anticlinal walls are sometimes slightly wavy and the stomata are more numerous, 130 to 260 per sq. mm. (Fig. 1, B, ep_2: D.).

Mesophyll. Dorsiventral, the palisade on the upper surface consists of two layers of cells, the cells of the upper layer being very elongated, up to ten times as long as they are wide. (Fig. 1, B, p_1, p_2.) The spongy mesophyll consists of 3 to 4 layers of cells, the lowermost layer being often slightly elongated at right angles to the epidermis. (Fig. 1, B, s.)

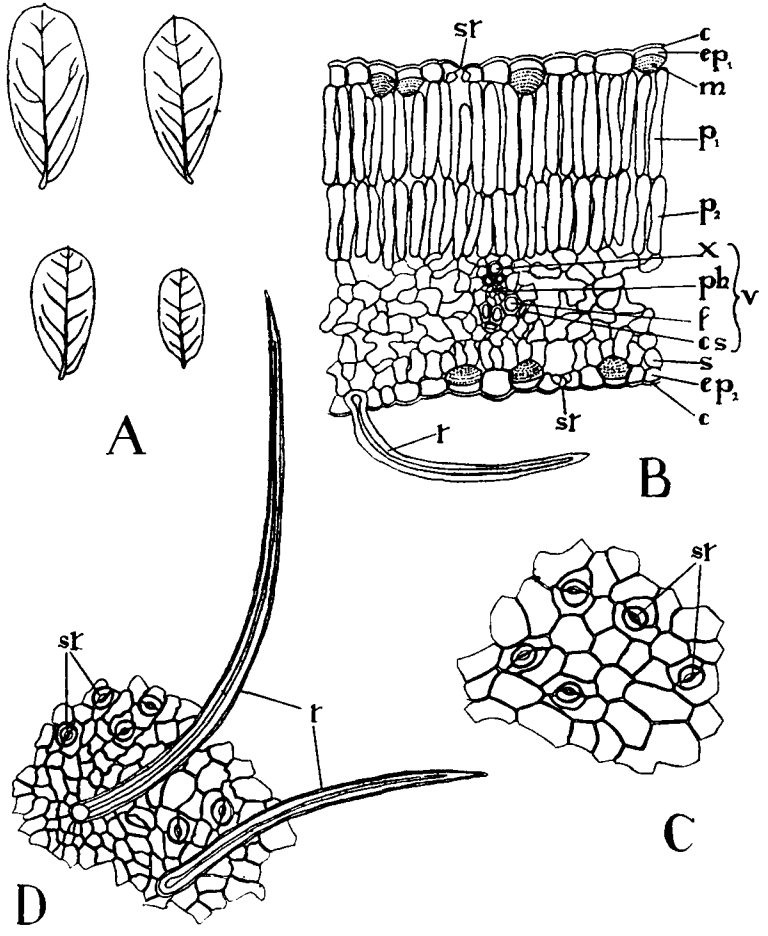

FIG. 1. *Cassia auriculata.*—A, whole leaflets, natural size; B, transverse section of lamina; C, upper epidermis, surface view; D, lower epidermis, surface view; c, cuticle; ep_1, upper epidermis; ep_2, lower epidermis; m, mucilage; p, upper layer of palisade; p_2, lower layer of palisade; x, xylem; ph, phloem; f, fibres; cs, crystal sheath; s, spongy mesophyll; st, stomata; t, trichomes; v, veinlet. All x 150, except A.

Cluster crystals of calcium oxalate, 6 to 8 to 15 to 20 microns in diameter occur, but are not common, being usually found along the main veins and most frequent in the neighbourhood of the midrib. Both layers of palisade are continuous over the midrib.

Stelar Tissues. The midrib consists of a radiate xylem, containing

annular, reticulate and pitted vessels, below which are groups of sieve tissue. There is an arc of pericyclic fibres below the phloem and a group of fibres above the xylem. The fibres are surrounded by a sheath of cells, each containing a single prism of calcium oxalate, 7 to **10** to **20** to 24 microns long by 4 to **5** to **8** to 10 microns wide. Both xylem vessels and fibres have lignified walls. The midrib projects slightly on the under side of the leaf, the projection being filled with collenchyma.

The large veins form a network and are accompanied by a complete crystal sheath, similar to that described for the midrib. In the smaller veinlets the complete sheath is lacking, but occasional prisms of calcium oxalate are found along these veinlets. (Fig. 1, B, v.)

Quantitative Data

Stomatal Index. The stomatal indices of Palthé senna and of the official sennas are:—

Cassia auriculata 7·1 to **9·0** to **13·0** to 14·5
Cassia acutifolia 8·1 to **10·0** to **14·0** to 15·5 (Rowson[5])
Cassia angustifolia 15·6 to **16·0** to **21·5** to 22·7 (Rowson[5]).

The stomatal index will thus serve to distinguish Palthé senna from Indian senna, but not from Alexandrian senna.

Vein-islet Number. The vein-islets numbers of the three sennas are:—
Cassia auriculata 18 to 26.
Cassia acutofolia 25 to 20 (Wallis[6])
Cassia angustifolia 20 to 23 (Wallis[6]).

This feature is thus available to distinguish *C. auriculata* from Alexandrian senna, but will not give a distinction from Tinnevelly senna.

Palisade Ratio. The palisade ratio of *Cassia auriculata* was determined under the same conditions as those used by George[7] for genuine senna. The results are:—
Cassia auriculata 2·5 to **4·5** to 8·0
Cassia acutifolia 3·5 to **8·0** to 18·0 (George[7])
Cassia angustifolia 2·5 to **5·6** to 12·0 (George[7]).

George reports that an average of 20 determinations on Alexandrian senna will give a result of over 7·5. On Palthé senna an average of 20 determinations may be expected to give a result of less than 6·0, so that palisade ratio determinations serve as a ready means of distinguishing these two species. The values obtained for *C. auriculata* and *C. angustifolia* are, however, too close for palisade ratios to be of much value in differentiating between these species.

Colour Reactions

Sulphuric Acid (80 per cent. v/v). As first reported by Vamossy[2], Palthé senna leaves give a crimson colour with 80 per cent. v/v sulphuric acid. This test may be carried out by sprinkling the broken leaves, or powder, on to the surface of the acid in a test-tube. When examining powdered senna for possible adulteration with Palthé senna, the test is best carried

out by mounting the powder in 80 per cent. v/v sulphuric acid and examining microscopically. Treated in this way, particles of Palthé senna show a brilliant crimson colour and 2 per cent., or less, of this leaf may be detected in admixture with genuine senna.

Chloral Hydrate. Heating Palthé senna leaves, whole or in powder, with solution of chloral hydrate (5 in 2), in a boiling water-bath also results in a crimson colour, changing to brownish-red on longer heating.

Bornträger's Reaction. Palthé senna leaves give no rose-red colour with Bornträger's reaction, either direct or after hydrolysis by boiling with dilute sulphuric acid. It was concluded from this that the leaves contain no anthraquinone derivatives; a fact which is confirmed by Wasicky[4]. It should be noted, however, that Maurin[8] reported finding 0·7 per cent. of oxymethylanthraquinones in the leaves of *C. auriculata* and 1·9 per cent. in the stem bark.

SUMMARY

The principal characters which serve to differentiate Palthé senna from the official sennas, particularly in the broken or powdered condition, are:—

1. The trichomes, which are about three times as long as those of genuine senna and lack a conspicuously warty cuticle.
2. The presence of two layers of palisade cells on the upper side of the leaf and none on the lower.
3. The cluster crystals being usually along the main veins, whereas the clusters of genuine senna are not found in the neighbourhood of the veins.
4. The presence of occasional prisms of calcium oxalate on the smaller veinlets, where they are lacking in the official sennas.
5. The palisade ratio, stomatal index and vein-islet number.
6. The colours produced by 80 per cent. v/v sulphuric acid and chloral hydrate.
7. The absence of anthraquinone derivatives, resulting in the leaf giving a negative result with Bornträger's reaction.

I wish to thank Dr. T. E. Wallis, the Curator of the Pharmaceutical Society's Museum, for the supply of authentic material and also for calling my attention to some of the literature cited. I am indebted to the Directors of Boots Pure Drug Company, Ltd., in whose Analytical Laboratories the work was carried out, for permission to publish this paper.

REFERENCES

1. *Pharm. Ztg.* through *Pharm. Era*, 1919, **52**, 289.
2. Vamossy, *Pharm. Monatsh.*, 1920, **1**, 77.
3. Thoms, *Handbuch der praktischen und wissenschaftlichen Pharmazie*, 1931, **5**, Part II, 1109.
4. Wasicky, *Lehrbuch der Physiopharmakognosie*, 1932, Part I, 317.
5. Rowson, *Quart. J. Pharm. Pharmacol.*, 1943, **16**, 24.
6. Wallis, *Textbook of Pharmacognosy*, Churchill, 1946, 121, 125.
7. George, *Quart. J. Pharm. Pharmacol.*, 1943, **16**, 226.
8. Maurin, *Bull. Sci. pharm.*, 1927, **34**, 10.