

JOURNAL

OF THE

WASHINGTON ACADEMY OF SCIENCES

VOL. 23

NOVEMBER 15, 1933

No. 11

CHEMISTRY.—*Notes on the occurrence of rotenone in species of Derris and Lonchocarpus.*¹ HOWARD A. JONES, Bureau of Chemistry and Soils. (Communicated by C. M. SMITH.)

In a recent article² data were given on the rotenone content of a number of samples of East Indian derris root (*Derris sp.*), South American cube root (*Lonchocarpus nicou*) and some other plants of the genus *Lonchocarpus*. Information has now been obtained on the occurrence of rotenone in the stems and leaves of derris and cube, and on the rotenone content of roots and stems of certain other South American plants.

No values are given in the literature for the rotenone content of either stem or leaf material of derris, although several investigators^{3,4,5} have reported the amount of total extractives in stem parts of *D. elliptica*, *D. uliginosa* and other species of *Derris*. Blackie⁶ has recently reported 0.3 per cent rotenone in a composite sample of stem and root of *D. uliginosa*, but it is uncertain whether the rotenone was contained in the stem or root portion. In the present investigation samples of the stems and leaves of both *D. elliptica* and *D. uliginosa* were examined, as well as a sample of "twigs and bark" of *D. uliginosa*, all obtained from Fiji. No rotenone could be detected in either the leaves or stems of *D. elliptica*, or in the leaves of *D. uliginosa*, by the color test for rotenone recently outlined.^{7,8} A positive color test was obtained from the stems of *D. uliginosa* and from the sample

¹ Received July 24, 1933.

² This JOURNAL 23: 36. 1933.

³ Pharm. Arch. 5: 145. 1902; 6: 1. 1903.

⁴ J. Agric. Research 17: 177. 1919.

⁵ J. Econ. Entom. 23: 619. 1930.

⁶ Agric. Jour. (Fiji Dept. Agric.) 5: 34. 1932.

⁷ Ind. Eng. Chem., Anal. Ed. 5: 75. 1933.

⁸ The rotenone color tests in this work were made on concentrated acetone extracts of the plant materials.

TABLE 1.—ROTENONE CONTENT OF VARIOUS MATERIALS

Sample Number	Plant Material	Source	Qualitative Color Test for Rotenone	Quantitative CCl ₄ Extraction	
				Rotenone	Total Extract
1535	Stems <i>Derris elliptica</i>	Fiji	Negative	—	—
	Leaves		Negative	—	—
1534	Stems <i>D. uliginosa</i>	Fiji	Positive	about 0.1 ^a	1.7
	Leaves		Negative	—	—
1309	<i>D. uliginosa</i> "twigs and bark"	Fiji	Faintly positive	None ^a	1.5
1498	Large stems <i>Lonchocarpus nicou</i>	Peru	Positive	about 0.1 ^b	1.4
	Small stems and rachises		Negative	—	—
	Leaves		Negative	—	—
1522	Roots <i>L. nicou</i>	Peru	Positive	8.3	17.8
	Stems		Positive	about 0.3 ^c	3.2
	Leaves		Negative	—	—
1291	<i>L. nicou</i> Leaves	Peru	Negative	—	—
1351	Fine roots <i>L. nicou</i>	Peru	Positive	7.2	19.8
	Coarse roots		Positive	2.0	7.2
	Whole root			3.5	10.8
1352	Fine roots <i>L. nicou</i>	Peru	Positive	6.9	17.0
	Bark of coarse roots		Positive	4.7	16.4
	Inner portion of coarse roots		Positive	1.2	5.0
	Whole root			2.9	9.3
618	Bark of root <i>L. velutinus</i>	Unknown	Negative	—	—
	Inner portion of root		Negative	—	—
	Bark of stem		Negative	—	—
785	<i>L. velutinus</i> Roots	Peru	Positive	1.9	12.2
1331	"Haiari" (<i>Lonchocarpus</i> sp.) Stems	Unknown	Positive	1.0	4.8
1451	<i>Lonchocarpus</i> sp. Roots	Paraguay	Positive	8.9	22.6
1452	"Cipo"; (<i>Lonchocarpus</i> sp.) Roots	Brazil	Positive	1.2	9.1
1387	"Timbo" Roots	Brazil	Positive	16.3	38.7

^a 100-gram sample.^b For determination of rotenone a 1-kilogram sample was extracted at room temperature with ethylene dichloride, the extract evaporated to dryness in a vacuum and the rotenone crystallized from carbon tetrachloride. Total extract determined by carbon tetrachloride extraction of a 150-gram sample.^c 150-gram sample.

of "twigs and bark" of the same species. By the carbon tetrachloride extraction method⁹ the stems gave about 0.1 per cent rotenone. No crystallizable quantity of rotenone could be obtained from the "twigs and bark."

Geoffroy¹⁰ in 1895 found from 2 to 2.5 per cent rotenone in large stems of *L. nicou* from French Guiana and stated that the young stems contained only small quantities and the leaves only traces. Several samples of stems and leaves of authentic *L. nicou* from Peru have now been examined for rotenone. One sample of material was divided into large stems (those over 5 mm. diameter), small stems (including the rachises of the large, pinnately compound leaves) and the separated leaflets, here designated as leaves. The large stems of this sample contained about 0.1 per cent rotenone while the small stems and the leaves contained none. Another sample consisted of roots and stems, the latter ranging from 1 cm. to 2 cm. diameter, both taken from the same plant, which was two years and five months old and was growing at an altitude of 600 feet above sea level. The leaves received with this sample were from this plant and other plants within a radius of fifteen feet. The roots contained a large proportion of rotenone while the stem material contained only about 0.3 per cent. No rotenone could be detected in the leaves. A third specimen, consisting of leaves only, contained no rotenone.

The distribution of rotenone in the roots of *L. nicou* was also studied. Two samples of material were divided into fine (those less than about 5 mm. diameter) and coarse roots, and these portions were analyzed separately. As seen from the results given in the table the fine roots contained a much larger proportion of rotenone in both cases. Similar results were previously obtained with derris root.¹¹ One sample of the coarse cube roots was stripped of its bark (probably including other tissues immediately under the bark), and this was analyzed separately from the inner part of the root. The bark and the peripheral structures contained a definitely larger proportion of rotenone than the inner portion.

Two samples of *L. velutinus* were tested for rotenone. One of these contained no rotenone, while the other contained about 2 per cent. A sample of "Haiari" stem, a sample of roots said to be of a species of *Lonchocarpus* from Paraguay and a sample of "cipo" roots from Brazil all contained appreciable quantities of rotenone.

⁹ Ind. Eng. Chem., Anal. Ed. 5: 23. 1933.

¹⁰ Ann. Inst. Colon. Marseille 2: 1. 1895.

¹¹ This JOURNAL 23: 36. 1933.

A sample of Brazilian "timbo" root contained about 16 per cent rotenone. This sample was submitted as *Paullinia pinnata*, but according to Killip and Smith¹² the term "timbo" is applied to *L. urucu* in the region from which this material came (Para). Unfortunately no leaf parts were submitted for botanical identification, and the root had undergone decomposition making impossible a microscopical comparison with an authentic sample of *P. pinnata*. A previous sample of "timbo" root from this same region contained about 5 per cent rotenone.¹¹

CONCLUSIONS

The results obtained indicate that the stems and leaves of derris and cube are of no value as commercial sources of rotenone.

Fine cube roots contain a higher proportion of rotenone than the coarse roots. The outer portion of the root has a higher rotenone content than the inner part.

Roots of other species of *Lonchocarpus* should be further investigated as possible sources of rotenone.

¹² This JOURNAL 20: 74. 1930.

PALEONTOLOGY.—*Salonia*, a new Ordovician brachiopod genus.¹

G. ARTHUR COOPER and LAWRENCE WHITCOMB. (Communicated by JOHN B. REESIDE, JR.)

The genus herein described is characterized by a distinctive external appearance and is particularly interesting as the earliest known

¹ Published by permission of the Secretary of the Smithsonian Institution. Received May 25, 1933.

Figs. 1-19.—*Salonia magnaplicata* Cooper and Whitcomb, n. sp.

Figs. 2, 3.—Ventral and dorsal valves respectively of a small individual (paratype 85422 *e*) showing the triangular outline, $\times 2$. Figs. 1, 4.—Same views as above of paratype 85422 *d*. Figure 1 shows the costella in the ventral sulcus, $\times 2$. Figs. 5, 7.—Ventral and dorsal views respectively of a larger specimen (paratype 85422 *c*) retaining the triangular form but showing the beginning of lobation. Figure 7 illustrates well the sulcus on the dorsal valve a little anterior to the beak. This soon inverts to form the prominent fold, $\times 2$. Figs. 11, 12.—Ventral and dorsal views respectively of a nearly full grown individual. In this specimen the fold and sulcus are more angular than the others. The costella of the sulcus shows plainly in figure 11. Patches of shell substance may be seen in figure 12, which indicate how thin the shell was. Paratype 85422 *b*, $\times 2$. Figs. 6, 8, 9, 10.—Respectively posterior, ventral, dorsal and lateral views of the holotype 85422 *a*, $\times 1$. Figs. 15, 19.—Respectively ventral and dorsal views of the holotype, $\times 2$. Figs. 16, 17.—Posterior and lateral views respectively of the holotype, $\times 2$. Fig. 18.—Posterior view of the holotype showing strongly incurved dorsal beak. $\times 3$. Figs. 13, 14.—Posterior views of the dorsal interior showing the dental sockets and long brachial processes. These appear slender because they are seen from a ventral position. Compare figure 14 with text figure 22A. Figure 13 is of paratype 85422 *r*; figure 14 is of paratype 85422 *p*.

All of the specimens figured are from twelve feet above the base of the Trenton (*Salona*) formation, along the railroad track beside Fishing Creek, *Salona*, Clinton County, Pennsylvania.



Jones, Howard Allen. 1933. "Notes on the occurrence of rotenone in species of Derris and Lonchocarpus." *Journal of the Washington Academy of Sciences* 23, 493–496.

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