On an arrow-poison from New Granada and on its botanical source / Joseph Tillie.

With D. Tillie's compliments

I

Tillie, Joseph

On an arrow poison

FROM THE

JOURNAL OF ANATOMY AND PHYSIOLOGY

1893, Vol. XXVII.

ON AN ARROW-POISON FROM NEW GRANADA, AND ON ITS BOTANICAL SOURCE.

By Joseph Tillie, M.D., *Senior Assistant to the Professor of Materia Medica in the University of Edinburgh.*

Professor Sir William Turner lately handed to me for examination a gourd containing a quantity of the South American arrow-poison, Curara, and also several small pieces of stem, and a twig with leaves of plants said to be used to prepare the poison.

The specimens have been in Professor Sir William Turner's possession since 1863. They were brought to this country in that year by Dr James Whiteford, of Greenock, who resided in New Granada for several years, and had been requested by the late Sir Robert Christison to obtain information about the arrow-poisons of the country. I am indebted to Dr Whiteford for the following information regarding the locality. Both the poison (which was stated to be prepared only from climbing plants) and the botanical specimens were obtained in 1862 from the chief of a branch of the Rio Verde tribe of Indians, at a village named Musinga, situated about 50 to 60 miles to the west of the city of Antioquia, between the watersheds of the rivers Cauca and Atrato, in about 76° 36′ W. long., and 6° 40′ N. lat.

The poison is specially interesting, because it comes from the north-west of New Granada (Colombia), and we know nothing definite regarding the botanical sources of the poisons with which the darts used for the blow-pipe in these regions are smeared; nor, I believe, has the physiological action of any plant reputed to be a source of the poison been examined.

The pieces of stem are of two kinds, which differ considerably in size and external appearance.

One of the two pieces of stem is 6 cm. long and 1·5 cm. broad. The outer surface is greyish-brown, mottled here and there with irregular patches of ash-grey colour, and sparsely studded with wart-like projections, about 1 mm. high, and 1–2 mm. broad. Several large shallow longitudinal furrows extend the whole length of the stem, producing a slightly undulating

surface. Numerous small irregularly longitudinal furrows render the general surface finely rugose. The bark is only about 0·5 mm. thick. It shows under the lens three layers. The middle layer is pale, granular, and about 1½ time thicker than the layers which bound it, and which are conspicuous by their reddish-yellow colour. The bark is easily separable, and the surface next the wood is pale grey, and has, to the naked eye, the appearance of fine longitudinal striation. A transverse section of the bark shows under the microscope (1) a relatively thick exterior (suberous) zone, the outer cells deeply coloured yellowish-red, the inner only slightly coloured, and nearly rectangular in form. (2) A relatively thin (parenchymatous) layer of longitudinally arranged cells coloured reddish-yellow. (3) A very broad (sclerenchymatous) zone of large colourless polygonal irregularly-arranged thick-walled cells. (4) A relatively thin inmost (liber) layer, coloured reddish-yellow. The relative breadth of the layers is approximately, from without inwards, 3·5, 1, 6, 2·5. The wood has a diameter of 1·3 cm.; and an empty medullary canal, having a diameter of 4 mm., occupies a point nearly in the centre of the section. A sharply cut section shows a very large number of small openings, with here and there a large lacuna. The wood near the bark contains the largest number of openings, and they diminish greatly in size and number towards the medullary canal. The wood, especially near the medullary canal, shows numerous narrow unbroken streaks of a different shade from the pale-greyish ground tissue. The narrow streaks separate the ground tissue into relatively broad pale streaks, pierced by numerous openings, the different coloured streaks forming alternate layers arranged tangentially.

A second piece of stem (of which there were 3 similar pieces) is 7 cm. long, and 2·2 cm. broad. It is slightly curved, and the outer surface is of a dark rust colour, and shows no grey patches or wart-like projections. It has the shallow longitudinal furrows already described, but also a few deep transverse furrows on the side towards which it curves. The general surface is wavy, but is not covered by fine furrows, and, except for a very few flaky patches, the furrows and rounded ridges are smooth rather. The bark is only about 1 mm. thick, and the three layers previously described are ill-defined, owing to the small

amount of colouring-matter in the layer next the wood, which, however, is as broad as the other layers 1, 2, and 3 combined. The relatively narrow sclerenchymatous zone is also separated into two parts by an intermediate layer of cells resembling the inmost layer. The medullary canal is practically obliterated, and is excentric in position. The pale-grey coloured wood shows numerous small openings, and the large lacunæ are scattered equally over the whole section. The tangential arrangement of medullary rays and openings is seen under the lens, and a few irregular strips of tissue, passing here and there circumferentially, give a deceptive appearance of annual layers.

The twig is cylindroid; thornless; slightly furrowed longitudinally; pale green; branches opposite; the bases of the branches relatively thick from the persistence of the attachments of the petioles, and the finest branches covered with short brownish downy hairs, just visible to the naked eye. The leaves are opposite and without stipules. The petioles are 2 mm. long, and the largest leaves, of which there are five, have an extreme length of 10·4 cm., and an extreme breadth of 4·1 cm.; the smallest is 3 cm. long and 1·6 cm. broad; and the intermediate sizes average 5 cm. long and 2·8 cm. broad. The larger leaves are elliptical, with the base acute; the smaller sizes are ovate-elliptical; apices acuminate; margins perfectly entire and sparsely ciliated; membranous; upper surface light green, and under surface a paler green; glabrous on both surfaces, but veins on under surface are somewhat downy, especially the midrib; veins prominent on the under surface, and of a reddish-brown colour; prominently 3- but also less distinctly 5-nerved; a strongly marked midrib gives of at its extreme base two very fine, but in the smaller leaves sometimes very distinct, wavy veins, which follow the margin of the leaf at a distance of about 1 mm., but become faintly marked near its apex; two strongly marked veins arise opposite or almost opposite each other about 2 mm. above the base, and follow the margin of the leaf at a distance of about 5 mm., and run into the apex at its margin. Secondary veins, which are fairly well marked on the under surface of the leaf, pass almost transversely from the primary veins and from a network.

All the specimens, therefore, must be referred to the genus

Strychnos; but it is not known that the leafy twig was taken from either of the plants from which the pieces of stem were taken. In view of this circumstance, the absence of flowers and fruit, and the fact that the bark and wood of *Strychnos* plants often show, on microscopical examination, only relatively slight quantitative differences, the evidence is insufficient for the precise recognition of species.

The first described piece of stem resembles that of *Strychnos Gubleri* (Planch.),[1] the second that of *Strychnos toxifera* (Schomb.),[2] but the bark differs.

Some one or more of the characters of the twig and leaves—the downy hairs, absence of thorns, ciliated leaf margin, &c.—seem to distinguish the specimen from *Strychnos Hachensis*[3] (Krst.) (Venezuela); and also from plants known to be sources of the curara of other regions:—*S. Castelnœana*,[4] Wedd. (West Brazilian Guiana and Upper Amazon); *S. Gubleri*, Planch. (Venezuelan Guiana, Upper Orinoco); *S. toxifera*, Schomb. (British Guiana, Upper Essequibo); *S. Crevauxii*, Planch. (East Brazilian Guiana, Upper Paru), &c. It presents a very close resemblance to the *bejuco de Mavacure*, a *Strychnos* plant yielding the curara of the Upper Orinoco districts, collected by Humboldt and Bonpland[5] at Esmeraldas in Venezuelan Guiana at the beginning of the century, and described by Kunth, who inclined at that time to think that it was allied to, or the same as, the *Rouhamon Guyanense* of Aublet.[6] It is unfortunate that this historical plant, the first which was botanically recognised as the source of curara, is not precisely identified and named. It was later described by Kunth[7] as *Lasiostoma* (?) *Curare*, and by De Candolle[8] as *Rouhamon* (?) *Curare*. Planchon is of opinion, from an examination of Humboldt's specimens, that they do not agree with *R. Guyanense*. I notice

[1] *Comptes Rend.*, Jan. 19, 1880; *Journ. de Pharm. et de Chim.* [5], i. 293.

[2] Hooker, *Bot. Journ.*, iii. 240. [3] Karsten's *Flora Columbiæ*, vol. ii. p. 75.

[4] The literature and descriptions of the Curara-yielding Strychnos plants is collected by Planchon in a series of papers in the *Journ. de Pharm. et de Chim.* [5], vol. i. p. 19 *et seq.*, translated in the *Pharm. Journ. and Transac.*, 1880–1, 3rd Series, vol. xi. pp. 469, 492, 529, 589, 693, 754.

[5] *Voyage aux Régions Équinoxiales du Nouveau Continent*, Paris, 1814, T. ii. p. 549.

[6] *Hist. des Plantes de la Guiane Françoise*, 1775, vol. i. p. 94, pl. 36.

[7] *Nov. Gen. et Spec. Plant. Americ.*, vol. vii. p. 210. [8] *Prodromus*, ix. p. 17.

in Humboldt's work[1] that the similarity is only admitted apparently under the impression—" car les véritables Strychnos paroissent appartenir exclusivement aux Indes Orientales." On examining the representation in Aublet's work, I find that the shape and venation of the leaf (especially the secondary veins) are different in the specimen which I have described.

I have compared the specimens with the *Strychnos* plants in the Herbarium of the Royal Botanic Gardens of Edinburgh, but they do not correspond with any of them. On sending the specimens to the Royal Gardens at Kew, I learned, through the kindness of Mr Hemsley, that one of the specimens was identical with an unknown (flowerless) species of *Strychnos* collected by Jervise in New Granada.

The second bark which was described yielded to rectified and proof spirit 19·3 per cent. of a dark brownish-red extract in the form of a varnish, which was for the most part soluble in water. The solution was of a deep brownish-red colour, slightly acid in reaction, and distinctly bitter. The watery extract has the same characters.

The curara is almost black in colour, odourless, brittle, and easily powdered. It dissolves in water, leaving a slight residue. A 2 per cent. solution is dark red in colour, somewhat bitter, and has a slightly acid reaction. The physical characters of the curara are not opposed to the conclusion that it has been prepared from this bark.

On testing the pharmacological action of the watery and alcohol extracts obtained from both barks, I found the primary and only prominent action in brainless frogs to be a paralysing one upon the endings of the motor nerves. The curara from the gourd possessed, in small doses, a precisely similar action. The minimum dose which produced complete motor paralysis in the frog (R. temporaria) was found to be as follows:—

For the curara, . . . 0·000024 gramme per gramme weight of frog.

For the combined watery and alcohol extracts from the second bark which was described, . 0·000058 gramme per gramme weight of frog.

The extract of this bark has therefore less than half the

[1] *Loc. cit.*

poisonous activity of the curara, into the composition of which, as in the case of the curara of British Guiana,[1] several *Strychnos* plants probably enter.

The small quantity of extract of bark available did not allow of any further special examination. After the outer surface of the wood had been carefully filed to remove any traces of bark, it was found that the alcohol and watery extracts of the wood had, in the frog, no obvious pharmacological action in doses about 100 times greater than the paralysing dose of the extract of the bark.

A piece of the curara, or a few drops of a very concentrated solution, when applied to the cut surface of the spinal cord of a decapitated frog whose circulation had been arrested, produced no signs of local irritation, and after about 30 minutes the hitherto motionless animal exhibited feeble spontaneous and reflex spasms, partly tetanic and partly clonic. In a previous communication[2] I have shown that, when certain fallacies are guarded against, all curara specimens which paralyse the endings of motor, produce tetanus in large doses. This curara has only about $\frac{1}{80}$th of the paralysing and tetanising activity of the pure alkaloid, curarine. It is interesting to find that the same pharmacological actions are produced by the curara of the whole of the north of South America, and that it is obtained from plants of the same genus. New Granada has hitherto been the exception, as the only knowledge we possessed of its arrow-poisons was obtained nearly thirty-five years ago (shortly before the specimens which I have described were collected) by Hammond and Weir Mitchell,[3] who found that two poisons of unknown botanical origin, named Corroval and Vao, obtained from the Rio Darien, caused death by paralysing the heart, and, contrary to all other known curara, did not act upon the motor nerves. That cardiac poisons may also, however, enter into the composition of curara which acts upon the motor nerves is certain, since Boehm[4] has separated from some Venezuelan curara having the ordinary action an alkaloid which he has named Curine, and which I have found[5] to cause death by acting upon the heart.

[1] Reisen in *Brit. Guiana. Schomburgk*, 1840–41, p. 450.
[2] *Journ. Anat. and Physiol.*, 1889, vol. xxiv. p. 381.
[3] *Amer. Journ. Med. Sci.*, vol. xxxviii., Philadelphia, 1859, p. 25.
[4] *Chemische studien über das Curare*, Leipzig, 1886.
[5] *Op. cit.*, vol. xxv. p. 53.