A PRELIMINARY NOTICE

OF THE

AKAZGA ORDEAL OF WEST AFRICA,

AND OF ITS

ACTIVE PRINCIPLE.

(*Read before the Royal Society of Edinburgh, 29th April,* 1867.)

1. *Employment as an Ordeal, and General Characters.*—In several recently published works on African travel, accounts are given of the remarkable and violently poisonous properties of an ordeal called akazga. This would appear to have been first described by Du Chaillu, and submitted by him for examination to Professor John Torrey, of New York, in 1860. The quantity given to that gentleman was insufficient for a detailed investigation, but he reported that the plant appeared to belong to the Loganiaceæ, and that it was probably a species of strychnos.[1] Soon after this, a description of its employment in judicial investigations and many other particulars were published by that most entertaining of writers on African travel, Mr. Winwood Reade.[2] Some specimens of the plant were presented to the London Pharmaceutical Society, in 1862, by Mr. Simmonds, and were chemically examined by Messrs. Attfield and C. H. Wood, who believed that they obtained indications of the presence of strychnia.[3] In November, 1866, a paper was read before the Academy of Sciences at Paris, by MM. Pécholier and Saintpierre, in which the results are given of the examination of the toxic properties of a Gaboon ordeal, which they term "boundou," and which I have no doubt is the akazga ordeal. They conclude that this poison has a very similar action to

[1] 'Explorations and Adventures in Equatorial Africa,' by Paul B. Du Chaillu, p. 257.

[2] 'Savage Africa,' 1863.

[3] 'Pharmaceutical Journal and Transactions,' vol. iii, 1861-62, p. 300.

strychnia, producing tetanic convulsions, and in no direct manner affecting the cardiac action.[1]

A few specimens of the akazga were sent to this country, in 1864, by the Rev. A. Bushnell, of Baraka; and these were very kindly given to me for examination by Mr. Thomson, of Glasgow; and a further supply came from the same quarter in 1865. I am also indebted to these gentlemen, and to Dr. Nassau, of Bonita, for the very interesting and trustworthy information they have supplied regarding the employment of the ordeal; by which, principally, I am enabled to communicate the following particulars.

The poison is known among the various tribes who employ it as *akazga*, *boundou* (or *m'boundou*), *ikaja*, and *quai*. Akazga is probably derived from *nkazga*, which signifies pain or hurt. It is employed as an ordeal on the West Coast of Africa, in a district which extends for a considerable distance north and south of the equator and many miles inland, and also in the adjacent island of Corisco. Witchcraft is believed in almost universally over Africa as the cause of all deaths, of unexplainable misfortunes, and of many crimes; and to detect the witch this poison is employed. The medicine-man, who generally owes his exalted and influential position to the impunity with which he can swallow large doses of his favorite drug, names those who are to be subjected to the trial. The supposed witch—who may be of either sex and of any age, and who is frequently, therefore, a very different person from our ideal—is obliged to drink a certain quantity of the infusion prepared from the bark, and to step over a number of akazga sticks placed parallel to one another at the distance of two feet. If this can be done, the person tried is pronounced innocent; if guilty, difficulty is experienced in stepping over the sticks; they appear like large logs, to surmount which suitable efforts are made, and these are rendered more and more difficult by spasmodic muscular twitches, until the victim staggers and ultimately falls in tetanic convulsions. If the poison do not now immediately prove fatal, the knives and clubs of the onlookers quickly free the tribe of the supposed witch-possessor. In those cases in which the trial is successfully undergone, a copious flow of urine is described as occurring, and by this means the poison is supposed to be removed.

It is believed that several thousand persons are annually subjected to this ordeal, and that the fatal cases are about 50 per cent.

The akazga is not only used as a detecter of witchcraft, but also as a protector against its influence. Portions of the root

[1] 'Comptes Rendus,' 1866, p. 809.

are placed over and under the door for the common good of the household, or the charred wood is rubbed on the forehead to confer its peculiar benefits on the individual. It is used for numerous other superstitious purposes of a like nature to those customs which have existed in many countries now enjoying greater enlightenment. It also possesses a medicinal reputation, and is used in the treatment of various skin diseases, such as krakra,[1] and in suppression and other urinary disorders.

The akazga was sent to me in bundles which consisted of long, slender, and crooked stems, having their roots generally attached to them, but sometimes their leaf bearing branches only, and containing also a few complete plants, with roots, stem, and branches. The plant is usually about six feet in length; but some specimens were only four, and others as long as eight feet. They have generally a diameter of half an inch, and this varies from a quarter to one inch. The bark is of a yellowish-orange colour, and in some parts light red; and over it a grey efflorescence is frequently found. A few of the stems are of a dark-brown colour, with numerous yellow tubercles. The bark adheres firmly to the stem, but it can be readily detached after exposure to a gentle heat for some days. Its internal surface is light-brown. The space between the bark and the wood was found in a few pieces of akazga to be occupied by a large number of minute sparkling crystals, but it has not yet been determined whether these consist of a vegetable or mineral substance.

The wood is dense and hard, and, from the number of concentric circles, the plant is apparently of very slow growth.

The leaves are opposite, and oval-acuminate in form; the apex frequently consisting of a linear prolongation more than an inch in length. They have five parallel ribs, three of which are prominent.

The bark has an aromatic, strongly bitter taste, which is not persistent, and a slight bitterness may be perceived in the leaves and wood.

These general characters at once suggested that this plant is one of the Loganiaceæ; but, with the materials in my possession, it was impossible to identify it. Professor Belfour kindly placed at my disposal a large collection of West African plants, and with his assistance and that of Professor Dickson these were compared with the akazga, but we found nothing of an exactly similar description. Professor Oliver, of Kew, who is intimately acquainted with the flora of West Africa, also

[1] A pruriginous eruption common in West Africa.

examined some of my specimens, and considers that there is great reason to suppose that the plant is an undescribed one.

2. *Chemical Properties.*—When the inner surface of the bark is exposed to the action of nitric acid, a brown colour is produced. Hydrochloric acid causes a pinkish red, which changes to brown; and sulphuric acid, a brown colour, and subsequent charring.

Nitric acid caused a brownish orange on the outer surface of the wood; hydrochloric acid, a faint yellow with reddish spots; and sulphuric acid, a brown, followed by charring.

The dry bark may be readily reduced to a fine powder in a mortar. If this be boiled with successive portions of alcohol of 85 per cent., a clear, reddish-brown tincture is obtained, which becomes clouded on cooling. By distilling off the greater portion of the spirit, and evaporating the residue at a low heat in a vapour-bath, a brown, shining extract is procured, weighing from 12 to 15 per cent. of the bark employed, having a bitter taste, and, with concentrated nitric acid, changing to a brownish-yellow colour, which was not materially affected by heat, nor by solution of protochloride of tin. It is obvious that the active principle of akazga is contained in this extract, and to separate it the following method has been adopted, after several attempts with various processes:—

The extract is treated with a very dilute solution of tartaric acid, which removes 77 per cent., and then filtered. The clear, yellowish-brown, acid solution is shaken with successive portions of ether so long as any colour is removed, and by this means also a small quantity of an aromatic oil is separated from it. After decantation, a solution of carbonate of sodium is added to the liquor, as long as it causes a nearly colourless, flocculent precipitate, which can readily be ascertained by filtering and testing a small quantity. It is again shaken with ether, the decanted ether is agitated with three successive portions of distilled water, by means of which all impurities are removed, and finally received in a bottle containing a dilute solution of tartaric acid, and shaken with it. As soon as the ethereal solution is brought in contact with the acid, it becomes opalescent, but again assumes its normal appearance when agitated with it. This change is of some value in indicating the frequency with which the alkaline solution should be treated with ether, as, when the former becomes exhausted, this will no longer produce a milkiness on contact with tartaric acid. When this stage is reached, the tartaric solution is exposed to a gentle heat—to free it completely from ether—filtered, and again treated with carbonate of sodium, by means of which a bulky, colourless, and flocculent precipitate is obtained. This is collected on a filter, washed,

and dried by exposure to a gentle heat for a short time, and then by the action of sulphuric acid *in vacuo*.

By this means, a colourless, amorphous substance is obtained, which is the active principle of the akazga poison, and which possesses the general properties of a vegetable alkaloid. From 500 grains of the powdered bark I succeeded in obtaining 10 grains, or 2 per cent. An examination of its chemical properties proved it to be a new and hitherto undiscovered substance. For it I propose the name *akazgia*, which is derived from akazga—apparently the most usual, as it certainly is the most euphonious, of the synonyms of this ordeal-poison.

As this alkaloid has been separated from a plant which is almost certainly new to science, I have to express the hope that when the plant is described, akazga will be adopted as its specific name, and thus the usual connection of nomenclature between the vegetable alkaloid and its source will be maintained.

Akazgia is soluble in about sixty parts of cold absolute alcohol; in about sixteen parts of spirit of 85 per cent.; in about one hundred and twenty parts of anhydrous sulphuric ether; and in thirteen thousand parts of distilled water at a temperature of 50° Fahr. It is freely soluble in chloroform, in bisulphide of carbon, in benzole, and in sulphuric ether of specific gravity 0·735. It seems to crystallize with difficulty, but may be obtained in the form of minute prisms by the very slow evaporation of a solution in rectified spirit. An analysis of its platinum salt, and a determination of its combining proportion with dry hydrochloric acid, yielded 290 in the former, and 293 in the latter, as the equivalent of akazgia. A sufficient quantity has not been yet obtained to determine its formula.

Akazgia and its salts when heated become yellow, then melt, and give off fumes of a pungent, disagreeable odour, and finally become charred, but leave almost no residue if the heat be continued for a sufficient time. When so treated in a small test-tube, these fumes have an alkaline reaction; but when burned on an open plate they are acid.

Its solutions have an alkaline reaction and neutralise acids; and the salts are freely soluble in water, and have a very bitter taste. The bitterness is, however, very different from that of strychnia in its intensity and persistence. I found that when the $\frac{1}{100}$th of a grain of strychnia was dissolved in very dilute hydrochloric acid and placed on the tongue, an intense bitterness was caused, which continued for more than three hours. In an exactly similar experiment with akazgia, the bitterness produced was not so intense, it had greatly diminished in an hour

and a half, and it had completely disappeared in an hour and forty-five minutes.

Concentrated nitric, hydrochloric, and sulphuric acids change its colour to brown; but these in a diluted state—as well as many of the organic acids—form nearly colourless solutions with akazgia. It is precipitated from these solutions by hydrate, carbonate, and bicarbonate of sodium and of potassium; by ammonia; by iodide, sulphocyanate, ferrocyanide, and chromate of potassium; by phosphate of sodium, protochloride of tin, trichloride of gold, dichloride of platinum, potassio-mercuric iodide, carbazotic acid, tincture of galls, solution of iodine, and various other substances: but these precipitates are *never* crystalline. Corrosive sublimate causes an amorphous white precipitate, which is dissolved by heat, and reappears in a non-crystalline form when the solution has cooled. Chlorine produces a colourless amorphous precipitate which does not disappear on the addition of ammonia. When akazgia is treated with nitric acid and heat, a yellowish solution is formed; and protochloride of tin causes in this a grey precipitate, which is dissolved by again applying heat. With concentrated sulphuric acid and peroxide of manganese, bichromate of potassium, or any other of the usual oxidizing agents, the same succession of colours is produced (from blue to brown) which results from a similar treatment of strychnia. A violet colour is also produced by electrolysis.

3. *Physiological Action.*—The physiological action of the alcoholic extract of akazga is very similar to that of extract of nux vomica. In a gradually increasing series of doses, it was found that six tenths of a grain is the minimum fatal dose for a rabbit weighing about three pounds. When this was injected into the subcutaneous cellular tissue, reflex movements were exaggerated in nine minutes; tetanus occurred in ten, and the animal was dead in eleven minutes.

Five tenths of a grain given to a rabbit of the same weight caused a violent tetanic convulsion in eighteen minutes; and convulsion after convulsion rapidly succeeded each other, with gradually diminishing severity, until fifty-four minutes after the exhibition of the poison, when the animal assumed a natural position, and recovered so quickly as to appear perfectly well in little more than an hour.

The active principle, akazgia, produced exactly the same phenomena in corresponding doses. According to the analysis, each grain of this alkaloid should equal seven grains of extract, or fifty grains of dry bark; and I found the physiological results to agree admirably with this.

One tenth of a grain of akazgia was dissolved in a few minims of

very weak acetic acid, and injected into the cellular tissue of a rabbit weighing three and a quarter pounds. A spontaneous and slight spasm, with increase of sensibility, occurred in four minutes; a long-continued tetanic convulsion, commencing with a violent spring, followed in eight minutes, and this was immediately succeeded by a second; on the termination of which, a succession of muscular twitches occurred, and continued for a few seconds after the respirations had ceased. The rabbit was dead in eight minutes and forty seconds after the administration of the poison.

To a rabbit weighing three pounds, one twelfth of a grain of akazgia was administered in exactly the same way as in the last experiment. No effect was produced until eight minutes, when its back became slightly stiff, and this was soon followed by a spontaneous spasm. The rabbit fell in a tetanic convulsion in fifteen minutes, and the effort which it made to raise itself when this had ceased induced another convulsion. These continued to succeed each other until twenty-two minutes, when a very violent attack of tetanus occurred, at the end of which the rabbit lay for many seconds without any respiratory movement, and with its muscles faintly quivering, exactly as they do at the termination of a fatal administration. Instead of dying, however, a sudden gasp occurred, and was followed by respiratory movements, which quickly became normal. When the rabbit attempted to rise, the posterior half of its body was found to be partially paralysed, and it could barely elevate its head and shoulders with its yielding forelegs. There were, however, no further spontaneous spasms, though slight convulsive movements could be readily excited by faint touches; and from this condition, also, it completely recovered in an hour and forty minutes. The paralysed state gradually disappeared, and in about two hours after the exhibition of the poison the rabbit was jumping about in an apparently normal condition.

These experiments are sufficient to show that the active principle of akazga has exactly the same action as the extract, and a proportional activity to it.

It is difficult to make an exact comparison between the effects of akazgia and those of strychnia, as I have not succeeded in finding any investigation in which the minimum fatal dose of the latter substance was attempted to be determined. But, whether peculiar to akazga or not, it is interesting that a certain quantity of an ordeal-poison should be able to produce a condition which appears to approach as closely as possible to death, and that an extremely slight increase of the dose capable of doing this should very quickly cause violent symptoms and a rapidly fatal termination. The medicine-man is thus enabled,

by administering a proper dose, to produce effects with such rapidity as to prevent his victim from completing the test of stepping over a certain number of akazga sticks; while, should he so wish it, a very slight diminution of quantity will postpone the appearance of the symptoms, until this, in itself easy, task can be accomplished.

Another point of interest is, that an alkaloid should be found so closely resembling strychnia in its chemical and physiological properties. There are several instances in which the same natural order produces very similar active principles, so that this is by no means an unexampled occurrence. In the Loganiaceæ itself, strychnia, brucia, and igasuria already exist; and these are nearly identical in their physiological actions. In chemical properties, brucia and igasuria have much in common; and they are both readily distinguishable in this respect from strychnia. Akazgia conveniently completes this group, as its chemical properties are nearly allied to those of strychnia, whilst its connection with all the members is maintained by the similarity of its physiological actions.