

V.—*The Alkaloid of Hyoscyamus muticus and of Datura Stramonium grown in Egypt.*

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I. *Hyoscyamus muticus.*

IN a previous paper (Proc., 1898, 14, 240 ; Trans., 1899, 75, 72), we have shown that the *Hyoscyamus muticus* of India, which has long been used in Indian medical practice, contains the alkaloid hyoscyamine, unaccompanied by other mydriatic alkaloids, so that its isolation in the pure state is a comparatively easy operation.

The percentage of hyoscyamine found by us in the stems and leave of this sample of the Indian plant was 0·1 per cent.

Since the publication of this paper, a short communication has appeared (*Arch. Pharm.*, 1898, 236, 704) by Dr. Gadamer, in which he states that he has examined *Hyoscyamus muticus* grown in Egypt, and has found in the seed capsules and seeds 1·34 per cent. of hyoscyamine, and in the leaves as much as 1·393 per cent., whilst the stems contained 0·569 per cent. As these quantities are more than ten times as great as those found by us in the Indian plant, we have examined the alkaloid furnished by plants grown in Egypt, which

have been collected for us through the kindness of Mr. E. A. Floyer, Member of the Egyptian Institute.

The plant is very abundant in the desert. The material received weighed about 1.5 kilograms, and consisted of the leaves, stems, and flowers. In many cases, the fruits were fully formed and the seeds ripe. The seed was removed for examination whilst the stems and leaves were operated upon together.

Seeds.—About 60 grams were obtained and thoroughly dried in a current of warm air (about 40°). They were then ground to a fine powder, and the alkaloid extracted by the process previously described (*loc. cit.*). As in the case of the Indian plant, the hyoscyamine was obtained in a crystalline condition. The quantity corresponded with 0.87 per cent., calculated on the dry material. In fractionally crystallising this alkaloid, by adding light petroleum to its solution in dry chloroform, it was nearly all obtained in white, silky needles melting at 105°, which furnished a crystalline aurichloride melting at 160° and containing 31.55 per cent. of gold. There is therefore no doubt that the crystalline alkaloid is pure hyoscyamine. As two very small fractions presented themselves in a gummy, semi-crystalline state, they were converted into aurichloride, and this was fractionally crystallised. Nothing, however, was obtained beyond an aurichloride melting at 160° and containing 31.3 per cent. of gold, so that no other alkaloid than hyoscyamine was present.

Stems and Leaves.—The mixture of stems and leaves was thoroughly dried, finely powdered, and the alkaloid extracted. It amounted to 0.59 per cent. on the dried material. This alkaloid crystallised readily from its solution in chloroform and possessed all the properties of hyoscyamine. A quantity was converted into the aurichloride and fractionally crystallised. All the fractions melted between 159° and 160° and contained between 31 and 31.5 per cent. of gold, so that it may be safely concluded that no other alkaloid than hyoscyamine was present. A non-alkaloidal substance was, however, isolated from the crystalline material first obtained. It was noticed in crystallising the original alkaloid from chloroform. On recrystallising this substance from alcohol, it was obtained in flat, rectangular plates melting at 196—198°. It was not readily dissolved by cold water, although easily soluble when heated; the aqueous solution was quite neutral. It left no residue on ignition, and although it contained nitrogen, did not react with alkaloidal reagents, nor did it exhibit the properties of a base. It was also devoid of acid properties, being only sparingly soluble in cold aqueous alkalis, whilst the solution obtained by heating deposited, on cooling, the unchanged substance. It did not reduce Fehling's solution before or after boiling with dilute sulphuric acid. Its taste was distinctly bitter. The quantity of the substance avail-

able did not allow of its further investigation, but we intend, when a fresh supply of material has been obtained, to investigate its properties more fully.

It thus appears that *Hyoscyamus muticus* grown in Egypt resembles that grown in India in containing practically pure hyoscyamine. The amount of this alkaloid furnished by the Egyptian plant is, however, considerably greater than that yielded by the same plant grown in India. It must, however, be borne in mind that, so far, only one sample of the Indian plant has been examined, and it is well known that the quantity of alkaloid in atropaceous plants varies considerably with their age. The examination of other samples of the Indian plant will, therefore, be necessary before it can be definitely concluded that the larger proportion of alkaloid now found is due to the growth of the plant in Egypt.

The rather larger percentages recorded by Dr. Gadamer may be partly accounted for by his having employed Keller's volumetric method of estimation, whereas we have isolated and weighed the crystalline alkaloid; and partly also by the age of the plant examined, as to which we have no information.

The percentages of hyoscyamine recorded for *Hyoscyamus muticus* grown in Egypt are very much higher than those hitherto recorded for any atropaceous plant, and this, taken with the fact that hyoscyamine can be so readily obtained in a pure condition from this material, makes *Hyoscyamus muticus* a valuable commercial source of this alkaloid.

Mr. Floyer informs us that any quantity can be readily grown in the Egyptian desert, and that a demand for a large supply could easily be met.

II. *Datura Stramonium*.

Through the kindness of Mr. Floyer, we have been enabled to examine a specimen of the *Datura Stramonium* grown in Upper Egypt. The European plant is well known, and somewhat extensively used in medicine. It was at one time supposed to contain an alkaloid daturine, which subsequent research proved to be a mixture of atropine and hyoscyamine. As difference of climate and soil is known to produce considerable alteration in the constituents in plants, we were glad of the opportunity to examine the Egyptian Stramonium.

From the plant as received, consisting of thick, succulent stems, holding large, ripe fruits but very little leaf, the seeds were removed, and the remainder, consisting of the stem, broken leaves, and fruit cases, separately examined.

Seeds.—About 42 grams were obtained and dried in the air. They were then examined in precisely the same manner as those of *Hyos-*

cyamus muticus. 0·35 per cent. of the crystalline alkaloid was obtained melting at 104°, and showing all the characters of hyoscyamine. Its aurichloride, after recrystallisation, melted at 159°, and contained 31·29 per cent. of gold. The whole of the alkaloid was converted into aurichloride, and this was fractionally recrystallised. In no case was any aurichloride obtained other than that of hyoscyamine.

Stems and Leaves.—The mixture of stems and leaves, amounting to about 80 grams, was air-dried and examined in the same manner as *Hyoscyamus muticus*. 0·3 per cent. of alkaloid was obtained, which, however, did not crystallise readily, but separated in a semi-gummy state. The whole of it was therefore converted into aurichloride and fractionally crystallised. With the exception of a minute, granular fraction melting below 130°, which was probably the aurichloride of atropine, the whole of the gold salt was obtained in shiny, crystalline scales characteristic of hyoscyamine aurichloride. They melted at 159°, and contained 31·37 per cent. of gold. The influence of minute quantities of other alkaloids in hindering the crystallisation of hyoscyamine is well known.

It therefore appears that the *Datura Stramonium* of Egypt differs from that grown in Europe in containing hyoscyamine unaccompanied by other atropaceous alkaloids, although, as has been pointed out in the previous paper, the nature of the alkaloid contained in plants belonging to this natural order is liable to vary considerably with age, and therefore this difference may not be in reality a fundamental one.

It is obvious that both these plants merit the attention of those concerned with their utilisation in medicine and pharmacy, as an abundant supply of either could be obtained in Egypt.

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