

TABLE.

No. of Cases.	Height.	Time of Clonus.	No. of Cases.	Height.	Time of Clonus.
	Ft. In.	Per sec.		Ft. In.	Per sec.
1.	6 4	6·0	25.	5 8	7·0
2.	6 2	6·25	26.	5 8	7·4
3.	6 2	5·0	27.	5 8	6·4
4.	6 1½	5·5	28.	5 8	6·33
5.	6 1	5·2	29.	5 8	7·0
6.	6 1	5·7	30.	5 7½	6·75
7.	6 0	5·3	31.	5 7	6·25
8.	6 0	6·25	32.	5 7	7·5
9.	6 0	6·53	33.	5 7	6·7
10.	6 0	6·75	34.	5 7	6·25
11.	5 11	6·85	35.	5 7	6·82
12.	5 11	6·66	36.	5 6	6·0
13.	5 11	6·37	37.	5 6	7·0
14.	5 11	6·6	38.	5 6	6·2
15.	5 11	6·4	39.	5 6	6·1
16.	5 11	6·0	40.	5 5½	6·75
17.	5 10½	6·2	41.	5 5	6·7
18.	5 10	6·0	42.	5 5	6·8
19.	5 10	6·2	43.	5 5	7·0
20.	5 10	6·83	44.	5 4	7·0
21.	5 10	6·0	45.	5 2	7·25
22.	5 9½	6·83	46.f.	5 2	7·2
23.	5 9	6·0	47.f.	5 2	7·2
24.	5 9	5·7	48.	5 1	6·75

ARTICLE III.—*Carmedik, a Cape Bitter; its Characters and Chemistry.* By MATTHEW HAY, M.D., Assistant to the Professor of Materia Medica, University of Edinburgh.

IN June of last year Mr A. P. Myburgh, a medical student from the Cape, very kindly presented me with a small quantity of an herb which, he told me, is much used throughout Cape Colony as a bitter tonic, and, excepting buchu, is the most commonly employed of the native medicines. It is known by the name of Carmedik, or, according to the Dutch spelling, Karmedik. A glance at its thistle-like appearance at once showed me that it belonged to the wide-spread order of the Compositæ, and to the subdivision of the Cynarocephalæ. I sent a portion of it to the late Mr Sadler, curator of the Royal Botanic Gardens, who, after examining it and comparing it with all the known species of the Cynarocephalæ, kindly informed me that neither he nor any of the members of the Botanical Society, at a meeting of which it was exhibited, were able to recognise it as a known species of thistle. He believed that it belonged to the genus *Carthamus*, and was closely related to *Carthamus tinctorius*.

Habitat.—Mr Myburgh procured the specimen given me from East Somerset, in the eastern province of Cape Colony, a district nearly 500 miles from Cape Town, and about 100 miles from the sea coast. But I understand from other Cape students that it is found in abundance over the greater part of the colony. Wherever it is met with it grows in large quantity, and it is especially to be seen in freshly ploughed fields, growing ahead of and choking the young cereals. It is therefore a troublesome weed as well as a useful medicine to the farmers of the colony. It grows quite like the common thistle of this country, and when it is to be used medicinally the plant is cut down and dried just before the heads have come to maturity. The whole plant is then infused in water or in brandy, and the infusion is drunk in all cases where a stomachic bitter is supposed to be of service. Buchu, which is the other great universal medicine of the colony, is infused in exactly the same manner.

Botanical Characters.—The carmedik I received consisted of the whole flowering plant except the root.

The *stem* was from 6 to 9 inches in length, and not more than $\frac{1}{4}$ inch in diameter, and was of a tolerably bright pinkish tint, which strongly contrasted with the bright green colour of the leaves. It was ribbed and somewhat angular, and was covered with short, whitish, woolly hairs. It had no aroma, and on being chewed was found to be only slightly bitter.

The *leaves* were alternate, sessile, and exstipulate, and measured from $2\frac{1}{2}$ to 3 inches in length; ovate-lanceolate and acutely and irregularly sinuous, with a large cusp between the sinuses, and smaller cusps in each sinus; acute at the apex; of a bright green colour, and with a well-marked reticulation, especially of the under surface, the veins having a reddish tint. The odour of the leaves slightly resembled that of tea. The taste was strongly bitter and moderately persistent, and very slightly aromatic.

The *flowers* or flower-heads closely resembled in general appearance those of the common thistle, and were nearly full-blown. The largest of them was about $1\frac{1}{4}$ inch in length and 1 inch in diameter. Each compound flower was surrounded at its base with a number of closely set leaves, and more immediately by adherent, firm, smooth, straw-coloured bracts, each of which terminated in a thorny-pointed branching cusp $\frac{1}{2}$ inch to $\frac{3}{4}$ inch long. The florets were tubular, narrow, white, and silky. The bracts were slightly bitter to the taste, and the flowers hardly at all.

From this examination of the plant it will be observed that the bitter principle is almost entirely resident in the leaves, and only to a very limited extent in the stem and flowers. The leaves, therefore, should be chosen when it is desired to use the plant medicinally. In order to ascertain the relative weights of the leaves, stems, and flowers, I carefully plucked to pieces most of the plants at my disposal. They were previously well dried.

The leaves weighed 257·7 grains ; the stems, 193·0 grains ; the flowers, 269·2 grains. The leaves, therefore, weighed between one-third and one-half of the weight of the whole plant.

Chemical Examination.—As the leaves mainly contain the bitter principle, these alone were used for the isolation of this and the other active constituents of the plant.

The leaves, dried and pulverized, were infused twice in succession, for a period of twenty-four hours on each occasion, with boiling water, and then strained. The filtered infusion was now gently heated over the water-bath, and evaporated to a syrup, which was treated with absolute alcohol to precipitate albuminous and other medicinally inert substances. The fluid was filtered, and the precipitated residue well washed with absolute alcohol until it no longer possessed any bitterness. The alcoholic filtrate containing the whole of the bitter principle was now evaporated, dissolved in water, and treated with a little dilute sulphuric acid, which occasioned a small precipitate. This precipitate was slightly bitter to the taste, greenish-brown in colour, viscid, freely soluble in potash, and slowly soluble in ether. A qualitative examination of it showed that it consisted mainly of a resinous acid and of a little chlorophyll, carrying with them a small quantity of the bitter principle. The filtrate, freed from the precipitate, was shaken repeatedly with ether, and the ethereal solution, after being washed several times by shaking with water, was evaporated, leaving a small quantity of an intensely bitter, greenish residue, which contained practically the whole of the bitter principle of the plant, since the watery solution from which it was removed by shaking with ether had almost completely lost its bitterness. It was hardly necessary, therefore, to examine the watery solution further. I did, however, remove the sulphuric acid and render it alkaline by means of barium hydrate, and filtered and extracted both the precipitate and the filtrate with ether. But neither from the filtrate nor the precipitate did the ether extract anything whatever. It was now tolerably certain, from the relation of the bitter principle to ether in the presence of acid, that it was not alkaloidal.

The bitter greenish residue, which I have mentioned as being obtained by evaporation of the ethereal solution, was partly oily and resinous, but mostly crystalline. It was neutral in reaction, and dissolved entirely in alcohol, but only partially and slowly in water. Its solution in alcohol was mixed and digested with purified animal charcoal in order to remove the colouring matter and the resin. The filtrate, which was perfectly colourless, was very gently and slowly evaporated to dryness over the water-bath. An almost colourless residue was obtained, with an intensely bitter taste. On being examined microscopically it was seen to consist almost entirely of numerous rhomboidal crystals, mixed with a very few globular resinoid or oily particles. To remove the resin, it was treated with water, in which the crystals dissolved and the

resin remained undissolved. The filtrate was again digested with pure charcoal and again gently evaporated. A perfectly colourless crystalline residue was now obtained, which was freely soluble in alcohol and ether, and somewhat less soluble in water.

These colourless crystals constitute, without doubt, the bitter principle of carmedik. Their solution in water was perfectly neutral, and they burned without residue, gave no odour of ammonia on heating with soda-lime, and, boiled for some minutes with dilute sulphuric acid, neutralized, and tested with Fehling's cupric solution, showed no trace of sugar. They are, therefore, crystals of a *neutral, non-glucosidal active principle*, to which I propose to give the name of *carmedicin*.

A solution of carmedicin in water was tested with a few reagents. With platinic chloride, picric acid, neutral acetate of lead, potassio-iodide of mercury, phospho-tungstate of soda, and phospho-wolframic acid, it gave no precipitate. With iodine dissolved in iodide of potassium it formed a slight yellowish opacity, and with tannic acid it yielded a scanty white precipitate. Subacetate of lead was much the best precipitant, throwing down a bulky white precipitate.

I made no elementary analysis of the neutral principle, as the quantity of the original drug at my disposal was too small to permit of my procuring the principle in sufficient quantity and purity for this purpose. A sufficiently pure principle could probably be obtained by decomposing the lead precipitate with sulphuretted hydrogen.

Besides a neutral principle and a *resin*, whose presence I have more than once taken notice of, the leaves of carmedik contain a small quantity of a yellowish *volatile oil*, possessing, however, very little aroma, and a small quantity of a variety of *tannin*. The volatile oil can be separated by distillation in the usual manner, and the tannic acid can be readily detected by the addition of ferric chloride to an aqueous infusion of the leaves, the infusion assuming a tolerably deep greenish-brown colour.

As regards the physiological action of the neutral principle, the quantity I obtained of the principle was insufficient to permit of my being able to give a perfectly definite opinion. A dose of half a grain, apart from its intense bitterness, produced no perceptible effect.

From this examination of the chemical composition of carmedik it is evident that it is a simple vegetable bitter, with a certain degree of aroma due to the presence of a volatile oil, and is, therefore, to be classed with the tolerably large group of aromatic bitters of which there are a few in the British Pharmacopœia, one, indeed—chamomile—belonging to the same order as carmedik. Bitter neutral principles are extremely common in the order of the Compositæ, although they exist to a smaller extent in the sub-order of the thistles or the Cynarocephalæ than they do in

the other sub-orders, most of the species of the thistle, indigenous or cultivated, in this country possessing little or no bitterness. Nativelle¹ has separated a bitter principle from *Cnicus benedictus*, a member of the Cynarocephalæ, and Scribe² has obtained from *Centaurea calcitripa*, also belonging to the same sub-order, a principle which he believes to be identical with the cnicin of Nativelle; and it is possible that carmedicin is likewise identical with it, or is closely related to it. Its physical and chemical characters, at least, are, so far as I have been able to compare them with those of cnicin, not opposed to this supposition.

For the purpose of obtaining an idea of the value of carmedik as a bitter tonic, I compared an infusion of it with some infusions of the Pharmacopœia as regards the intensity of their bitterness, assuming that the value of these tonics is in proportion to such intensity. One part of the leaves was mixed with twenty parts of boiling water, the usual pharmacopœial proportion, and infused for half an hour and drained. The infusion had a light golden-yellow colour, a distinct and slightly aromatic odour, and a fairly persistent, highly bitter, slightly aromatic taste. Compared with infusion of chamomile (B.P.), in which the same proportion of water and drug is used, the infusion of carmedik was considerably more bitter, but much less aromatic; with infusion of calumba (B.P.) it was of nearly equal bitterness, but more pleasant to the taste on account of the aroma; with infusion of chiretta (B.P.), which is made with a less proportion of the drug, it was slightly more bitter; with infusion of quassia (B.P.) it was decidedly more bitter; with compound infusion of gentian it was also very distinctly more bitter. Diluting it with water, and comparing it with the last two infusions, it was found that four times its bulk of water required to be added before it equalled in bitterness these infusions.

Carmedik is, therefore, a bitter tonic possessing a considerable degree of bitterness, more than many of the pharmacopœial bitters, and having a slight aroma which renders its taste somewhat agreeable. It does not appear to possess any special advantages over the vegetable bitters already in use in this country, and it is burdened with the disadvantage common to most of these, that it contains tannin, which is generally regarded as an obstacle to their prescription with salts of iron. It grows, however, so abundantly at the Cape, and could, therefore, be obtained so cheaply, that a trial of it as a substitute for our better-known bitters might be justified, especially since it is so highly prized and exclusively employed as a tonic by the provincials of Cape Colony.

In the carrying out of the operations involved in this investigation I was constantly assisted by Mr A. W. Leicester, medical student, to whom I tender my warmest thanks.

¹ Nativelle, *Journ. chim. méd.*, xxi. 69.

² Scribe, *Compt. rend.*, xv. 802.