

indicate nearly those found when the balance is in good working condition, and fairly weighted.

All these balances, when in equilibrium, will turn with a very small additional weight, equal to the value of two or three divisions, placed in one of the pans. They are exceedingly sensitive, for the sensibility of a balance is to be measured by the least amount of additional weight placed in either pan that is sufficient to turn the index-pointer from its normal position, when the balance is in equilibrium, and by the greatest amount of deviation from the normal position which is produced by a very small difference in the weights.

H. W. CHISHOLM

(To be continued.)

CINCHONA CULTURE*

FEW subjects have been so frequently before pharmaceutical readers during the past ten or fifteen years as the efforts of the governments of Holland and Great Britain to introduce the various species of Cinchona into their respective colonies. It would be hardly possible to overrate the importance of the enterprise, and it is one that interests alike the pharmacist, the botanist, and the votary of economic science. The records of progress which have been made public are so scattered and unconnected, the opinions and reports so conflicting, that it has been difficult for the general reader to retain the thread of the story or to arrive at any very clear estimate of the present position and prospects of the undertaking. The earliest steps in this great experiment in acclimatisation date back to a period before that which we have had under review, but so far as results are concerned, the subject is one which pertains essentially to the past few years, and I propose to place before you, in a few words as may be, and unencumbered by the controversial matter with which its literature abounds, an outline of the beginning of the enterprise and of its present practical aspect.

The initiative in Cinchona cultivation was taken, as you well know, by the Dutch Government, whose efforts were directed to its introduction into the Island of Java. The first Cinchona trees which were sent out to that colony were a few specimens of *C. Calisaya* † raised from seeds collected by M. Weddell in Bolivia, and forwarded by a firm of nurserymen in Paris in exchange for rare Javan plants. In the same year, 1852, the Dutch Government were induced to send M. Hasskarl, a gentleman previously attached to the Botanic Gardens at Buitzenorg, on a mission to South America, for the purpose of collecting plants and seeds. During the two years following M. Hasskarl pursued his labours, and succeeded in forwarding consignments from some parts of Peru, the Cinchona districts of Bolivia being for the most part closed against him; and his efforts were supplemented as to the New Granada species by the assistance of Dr. Karsten. The resulting collections were sent in part direct to Java, and the remainder to Amsterdam for re-shipment. I need not dwell on the mishaps and disappointments inevitable in so new and difficult an enterprise—it is sufficient to note that within three or four years, that is by the middle of 1856, upwards of 250 plants, almost exclusively of two species, *C. Pahudiana* and *C. Calisaya*, were flourishing in the Java plantation as the outcome of the expedition. In the same year, with wise forethought, an accomplished chemist, Dr. De Vrij, was sent out to conduct chemical observations on the growing barks.

We may pass over the long series of troubles that attended the early efforts of those in charge of the trees,

* From the Address delivered at the Pharmaceutical Conference, Bradford, by Henry B. Brady, F.L.S., F.S.C., President.

† My friend, J. E. Howard, F.L.S., to whose kind revision subsequent paragraphs owe any scientific value they possess, tells me that, accurate speaking, these were *C. Calisaya*, and var. *Josephiana*.

the ravages of insects, the destruction of young plants by rats, the devastation committed by wild cattle and rhinoceroses, and, above all, the difficulties dependent on climate, which eventually necessitated the transplantation of nearly the whole of the trees from the locality first chosen, on the north side of the mountain range, to one with a southern aspect. We will pass on, I say, to the year 1863, and we shall find that the total number of Cinchona trees in Java was then 1,151,810. Of these about 99 per cent. were of the species known as *C. Pahudiana*, the remainder comprising about 12,000 of *C. Calisaya* and trifling numbers of four other species. This proportion was unfortunate, for the bark of *C. Pahudiana* was found to be deficient in alkaloids, and therefore supposed to be valueless, and by decrees dated 1862 and 1864 its further culture was ordered to be forthwith stopped.

We may now turn to the steps taken by the British Government in the same direction.

Dr. Ainsley, in his work on "Materia Medica," was perhaps the first to suggest the idea of the acclimatisation of the Cinchona in India, and, as early as 1839, Dr. Forbes Royle especially indicated the Neigherry and Sihet mountains as eligible for the experiment. Appeals were subsequently made to the East India Company by Mr. Grant and Dr. Falconar, with the object of inducing them to take up the matter, and in 1852 instructions were sent to the British consular agents in South America to endeavour to procure seeds of the various species, but without much real effect. Dr. Royle, as Reporter on the Products of India, continued to urge the subject on the attention of Government up to the time of his death, and eventually, in 1859, at the instance of his successor in office, Dr. Forbes Watson, the services of Mr. Clements R. Markham were called into request by the home authorities.

Mr. Markham proposed a fourfold expedition to South America, and his scheme was at last sanctioned by the Secretary of State for India, and ordered to be carried out. The first portion of the expedition was directed to Bolivia and Carabaya, the region of *Cinchona Calisaya* and *C. micrantha* (var. *Boliviana*). Secondly, Huanuco and Huamalies were to be searched for *C. nitida* and *C. glandulifera*. Thirdly, Cuenca and Loxa in the Republic of Ecuador for *C. Chahuarguera*, *C. Uritusinga*, and *C. Condaminea*; and lastly, New Granada as the habitat of *C. pitayo* and *C. lancifolia*. Mr. Pritchett and Mr. Spruce were appointed coadjutors to Mr. Markham, and the expeditions set out in 1859, the latter gentleman proceeding to the northern part of Bolivia, the district of the yellow barks; Mr. Spruce to the mountain region of Chimborazo, in quest of red cinchonas; Mr. Pritchett taking the grey bark forests of Huanuco, in the north of Peru. The perils encountered by these travellers, the hardships they endured, the disappointments they suffered, form a chapter in the history of travel. But illness and privation, bad roads, and even native jealousies left unaffected the general success of the expedition, and though, unfortunately, the plants collected at great risk by Mr. Markham, including many of the best species of Bolivia, perished in the Red Sea in their transit to India, leaving no survivors, it is to the work accomplished by these three enthusiastic labourers that we owe the basis of our present Cinchona plantations. In 1860, the Ootamacund station was established, and the following year the number of young Cinchona trees was reported to be 1,128. Under the excellent care of Mr. McIvor these had been increased in 1863, the date to which I have brought my account of the Java plantations, to 248,166.

It is no part of my purpose to enter into minutiae of history, nor to do more than associate with the first steps in Cinchona culture the names of Messrs. Hasskarl and Markham, Spruce, and Pritchett as travellers, those of Dr. De Vrij and Mr. John Eliot Howard as advisers in technical details, and more recently, Messrs. McIvor and

Broughton, who have been conspicuous, so far as India is concerned, in the rapid development of the enterprise.

The efforts of our own Government have not been confined to India, but localities have been sought in other parts of the world where natural conditions seemed to favour the chance of success in the introduction of quinine-yielding trees, and at the time I speak of (1863) there were under the care of Mr. Thwaites in Ceylon upwards of 20,000 young *Cinchona* plants. Jamaica also had made a successful beginning, and the authorities of several European countries were considering how far their respective colonies might be utilised to the same end, though but little decided action beyond what I have stated had been taken.

The ten years that have intervened need not detain us, but having noticed the origin, we will turn at once to the practical aspect of the subject at the present time.

The latest official return places the number of *Cinchona* trees in cultivation in the Island of Java at two millions.

I can find no published account of the exact extent of the British plantations at the present time. My latest information I owe to the kindness of C. R. Markham, F.R.S., of the India Office. It is contained in the Parliamentary Blue-book of August 1870, and refers only to the Madras and Bengal Presidencies. This gives the total number of *Cinchona* plants growing on the Neilgherries in January of that year at 2,595,176, of which nearly one-half (1,143,844) were permanently planted out.* The number at Darjeeling in the Bengal Presidency in March 1870 is stated at 2,262,210, of which a million and a half were in permanent plantations.

Of the extent of the plantations in Ceylon and Jamaica I know nothing, but reports from time to time state that they are prospering. It is needless to refer to the experiments in cultivation in the south of Europe, the Caucasus, Brazil, the Philippines, or Australia, as these are not yet sufficient in extent to have any practical significance.

The relative value of the bark produced by the various species and varieties of *Cinchona* is a question that has received close attention, and perhaps cannot be considered settled until something more like uniformity in the subdivision and nomenclature of the genus prevails. Plants regarded as merely varieties of the same species yield widely differing proportions of alkaloids, and the subject is further complicated by considerations as to the possible effects of cultivation and of different climatal conditions. . . .

The barks now being produced in the Dutch and British colonies are referable to five species, viz. :—

C. Calisaya, of which, as I have said, only a small proportion realises expectation in its yield of quinine ;

C. Hasskarliana (called a hybrid), which appears to be of little value in respect of alkaloids ;

C. Pahudiana, deficient in the same particulars, but producing a bark which finds a ready market for pharmaceutical purposes ;

* Since this was written I have received a copy of a return which is believed to represent the actual number of *Cinchona* trees in the Government plantations in the Neilgherries at the present time. It shows an increase of 12,330 "planted out," and is as follows :—

Crown barks (<i>C. officinalis</i>)	...	...	...	508,878
Red barks	...	...	...	579,938
Yellow barks	...	...	...	33,850
Grey barks	...	...	...	23,759
Other species	...	...	...	4,749
				1,150,174

In addition to these it must be recollected that the Government had up to 1870 distributed upwards of 173,000 trees from the Neilgherry nurseries, as well as nearly three hundred ounces of the seeds of various species, to private individuals disposed to plant on their estates. After all, when the experimental stage of such an undertaking is over, private enterprise would seem to be its safest basis. A Parliamentary paper on the progress of India in 1872, just issued, gives the total number of plants in the Neilgherry plantations as 2,639,235, but this probably includes the very young trees still in nurseries. I have no particulars beyond what appear in a paragraph in the *Times*.

C. officinalis, which, in British India,* appears to be the most generally satisfactory ; and

C. succirubra, which, notwithstanding certain exceptional samples, has not turned out altogether well. . . .

I can say little about the West Indian plantations as to extent, but the quality of the bark they produce is encouraging. Mr. Howard reports that the chemical examination of barks from Jamaica is "highly satisfactory as regards the prospects of *Cinchona* culture in that island."

Various questions are still pending :—the influence of manures on the chemical constituents of the trees, the various methods of removing the bark from the tree, and the encouragement of renewal by the processes of stripping and mossaing, and many others of like importance, the solution of which must be left to time, and need not occupy our consideration here.

DONATI

SCIENCE, and more particularly astronomy, has recently sustained a serious loss in the death of Prof. G. B. Donati, Director of the Royal Observatory of Arcetri, near Florence, and Professor of Astronomy in the Royal Institution of that city.

On his return from Vienna, where he had represented Italy at the International Meteorological Congress, he was seized by a severe attack of Asiatic cholera, to which in a very short time he fell a victim, dying at his villa near the Observatory, on the morning of the 20th of September last, being only forty-seven years of age. He was born at Pisa in 1826. In 1852 he began his astronomical career at the Observatory of Florence, and by his talents, his attainments, and his indefatigable industry, rapidly gained the esteem and admiration of the learned, attaining a well-merited fame, not so much by the discovery of new comets—among which the most remarkable was that of 1858, to which he bequeathed his name—as by the important observations which he made and published. Of these we need only mention his observations on the study of the spectra of the stars, by which work he successfully inaugurated in 1860 one of the most important branches of physical astronomy, namely, the spectroscopy of celestial bodies.

In 1864 he succeeded Prof. G. B. Arnia as Director of the Observatory, after which much of his time and energy were devoted to the establishment of an observatory for Florence and for Italy, which should be completely adapted to the present exigencies of Science, both as regards astronomy and terrestrial physics.

He was in no way discouraged by the serious difficulties of this undertaking, but, inspired by a true love of Science, he overcame them all, insomuch that in a short time, under his active and keen-sighted superintendence, the new observatory was erected on the hill of Arcetri ; an observatory which, by the excellence of its position, as well as by the convenience and solidity of its construction, has guaranteed for astronomy and terrestrial physics the most important advantages in every branch of observation.

The observatory was already in working condition, and an important series of observations had been commenced when Science was robbed, by a premature death, of one of her most valued worshippers, who was thus cruelly cut off just as he had entered upon a brilliant career, in which, had he lived, he would certainly have greatly augmented his fame, and shed glory on the Observatory of Arcetri.

Prof. Donati had already commenced a series of notes from the new observatory by the recent publication of

* This limitation is at present necessary. Dr. De Vrij's late paper on Jamaica barks (*"Pharm. Journal,"* August 16, 1873) shows the produce of *C. officinalis* in that island to be very deficient in quinine, inferior indeed to *C. Pahudiana*, whilst a still later communication confirms Mr. Howard's opinion as to the richness of Indian-grown specimens.