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that he had slept for six months in a room where plants poisoned in a similar way were kept, and he had not felt any bad consequences. It would appear that Captain Norman must be peculiarly liable to be affected by mercury.]

VIII. *Report on the Cinchona Plantations of Ceylon, in a Letter to the Secretary of State for India.* By CLEMENTS R. MARKHAM, Esq.—Communicated by Dr GREVILLE, from a Colombo paper transmitted to him.

I have visited and inspected the Government Cinchona plantation in Ceylon, as well as some of the coffee estates where the cultivation has been undertaken, and now have to report the results of my observations.

The plants in Ceylon, with the exception of those of *C. Calisaya*, which came from Java, are entirely derived from seeds procured from South America under my superintendence, at the expense of the India Office, and the Ceylon cultivation may, therefore, be considered as a branch of the great undertaking which has been successfully carried out under the auspices of the Secretary of State for India.

In Ceylon, the Cinchona experiment is under the able superintendence of Mr Thwaites, the Director of the Botanical Garden at Peradenia, and the cultivation is conducted, under him, by Mr M'Nicholl, a very intelligent gardener, who resides on the spot. The first plants arrived in 1861, when the site for a plantation was selected by Mr Thwaites, and the work commenced.

The knot of mountains in the Central Province of Ceylon, which at one point attains a height of 8280 feet above the sea, is entirely composed of gneiss with veins of quartz. The soil formed by the disintegration of this rock is not rich,—not to be compared with the fertile loam produced by the more modern volcanic rocks of Java; but this poverty of soil is made up for by abundant supplies of water and a genial climate. The valleys formed by the mountain spurs are extensively cleared and planted with coffee; but there is still a good deal of forest on the higher elevations, and on one of the highest plateaux is the hill station of Neuera-Ellia, 6220 feet above the sea. From Kandy the mountains are ascended, on their northern face,

by an excellent road, and, as Neuera-Ellia is approached, the flora resembles closely that of the Pulneys, or of the Neilgherries, near Coonoor. The woods are, like those of the Southern Indian hills, composed of *Michelia*, *Symplocos*, *Gaultheria*, *Vaccinium*, myrtles, with an undergrowth of *Lobelia excelsa*, balsams, *Osbeckia* and *Sonerila*, *Solanum indicum*, a passion-flower, and madder. Beautiful tree ferns grow in the shade, and the *Rhododendron arboreum* is scattered over the open grass land. The station, consisting of bungalows nestling amongst Australian trees, is on a plain, bounded on the east and west by tree-covered hills crested here and there by bare ridges of gneiss. The masses of cryptogams on the branches and stems of the trees indicate the extreme dampness of the climate.

The *Cinchona* plantation is at a place called Hak-galle, six miles south of Neuera-Ellia, and 5200 feet above the level of the sea. The position is admirably chosen. Hak-galle is a magnificent perpendicular cliff, rising out of a fine forest which clothes the steep slopes of the mountain. The site faces the north-east. It is protected from the full force of the south-west monsoon by the cliff, while it receives a good supply of rain during both seasons. Half a mile on the road towards Neuera-Ellia the effects of the north-east monsoon are lost, and about a mile in the other direction is the limits of the influence of the south-west monsoon. Thus Hak-galle is exactly situated so as to receive ample supplies of moisture throughout the year. No place in the East has so vividly reminded me of the *Cinchona pajonales* of Peru as the view from the Hak-galle plantation. A mountain torrent dashes through the wide ravine, and the hills on either side are clothed with alternate forest and grass land, while to the south are the distant hills and valleys of the Oovah district. These open grass lands, called *patenas* in Ceylon, are precisely analogous to the *pajonales* of Peru. They are of frequent occurrence in the Ceylon hills, being covered with coarse tufts of lemon grass (*Andropogon Schoenanthus*), and the forest stopping abruptly on their verge. No trees grow on these *patenas*, except the *Rhododendron* and a very few others, and they are considered unsuitable for coffee cultivation. On the day of my visit to Hak-galle there were

showers from the south-west in the forenoon, and in the afternoon a dense mist rolled up from the Oovah valleys to the east, and enveloped the plantation. This is exactly the course of atmospheric daily change in the uplands of Caravaya, and as I watched the white mist wrapping tree after tree in its thick folds, I almost fancied myself standing on a *Cinchona pajonel* in Peru.

Some eight or ten acres have been cleared on the forest-covered slope, under the grand old Hak-galle cliff, and about five are now planted with *Cinchona* trees. It is worthy of remark that, although the roots of the felled trees have been allowed to remain in the ground, the *Cinchona* have in no instance been attacked by fungi, as was the case in Java. The plants are completely in the open, and look remarkably healthy and vigorous. In the lower part of the clearing are the plants of *C. succirubra*, which average a height of from 8 to 10 feet. Several are in flower. The largest tree is 18 feet 6 inches high, with a stem 14 inches in girth at the base. It was planted in February 1862. The *Calisaya* trees are smaller, but look healthy, and the specimens of *C. micrantha* look remarkably strong. The *C. officinalis* trees, of which kind about 4000 are planted out, are in the upper part of the clearing; they grow very fast, and have already yielded an abundant supply of seeds.

The nurseries for cuttings and young plants are beds containing many thousands placed close together, and merely shaded from the heat of the sun by a movable roofing of grass. An ordinary coolie puts in the cuttings, and the loss only amounts to a half per cent.; 2000 plants of *C. succirubra* have been raised from buds placed in drills, in the same way as French beans are raised, with half an inch of earth over them, and 90 per cent. came up; and of the *C. officinalis* seeds (thirty in each capsule) *all* came up. The total number of plants and cuttings is now upwards of 500,000. With reference to the method of taking the bark, I found that a tree of *C. succirubra*, which was cut down at Hak-galle for bark analysis in April 1864, had, in November 1865, sent up another shoot perpendicularly from the side of the old stem, which was 5 feet high and 5 inches in girth near the ground.

The most cheering feature in the Cinchona cultivation of Ceylon is the hearty way in which it has been taken up by the coffee planters. The facility for acquiring good titles, the excellence of the roads, and other advantages, probably render them, as a body, more enterprising than their brethren in India, and this important experiment is evidently destined to receive a fair and complete trial at their hands. The plants are given away by the Government, the only expense to the cultivator being their carriage to his estate. As many as fifty planters have made applications for plants; 500,000 plants have been asked for, and 180,000 actually distributed.

One of the most energetic Cinchona cultivators is Mr Corbett, who manages the estate of Rothschild, at Pusilawe (on the road from Peradenia to Neuera-Ellia), for the Ceylon Company. It may be looked upon as a representative estate. The coffee plants occupy the slopes on both sides of the Pusilawe valley, extending to the very crown of the grand hills of Moonera-galle, whose battlemented ridges of gneiss bound the view to the westward. Excepting a clump of Jacks high up on the eastern side, and some palms near the houses, every tree has been felled as far as the eye can reach, and rows of coffee plants entirely occupy the site of the primeval forest. No regard whatever has been paid to forest conservancy, belts of verdure are neither left along the water-courses nor on the hill tops, and planters have to send many miles for their firewood, yet there has been no sensible diminution of the water supply, and cascades and torrents dash over masses of rock through this coffee covered valley.

About four acres have been planted with Cinchona trees, on the Rothschild estate, on a steep hill slope, facing the east, all except one being of the red bark species. There are about 2500 plants, or 600 to an acre, planted 12 feet apart, alternating with coffee bushes. They are exposed to the full blaze of the sun, yet nothing can be more vigorous and healthy than their appearance. The oldest had been in the ground nearly three years, and are 12 feet high and 8 feet across the branches, with stems 13 inches in girth near the ground. But the majority of the plants were about 20 months old, with stems 8 inches in girth.

Mr Corbett is about to plant 600 acres with Cinchona plants at another estate, called Deekoya, which is 4000 feet above the sea. Rothschild only has an elevation of 3200 feet. He has applied for 100,000 plants, and has already received 10,000; and he calculates that, after three years, the cost of cultivation will be L.6 an acre, exclusive of original price of land and interest of money. This will ensure a very remunerative return on the sale of the bark.

As the object of the Ceylon Government in establishing the Hak-galle plantation is confined to supplying Cinchona to individuals who are willing to undertake the cultivation, the extensive plantations of the Neilgherries, where a far grander and more important system is contemplated, would, therefore, be out of place here. The expenditure on Hak-galle is only L.500 a-year, L.250 of which is the salary of Mr M'Nicholl, the gardener. But the Hak-galle plantation fully secures the object for which it was established; it is admirably managed by Mr M'Nicholl, and it forms a most efficient source of supply for the issue of young plants. I have no doubt whatever that Cinchona cultivation, under the auspices of the enterprising planters of Ceylon, will prove a great commercial success, and be a benefit of no small value to the inhabitants of the island.

I sail for Tuticorin on the 19th instant, in a native small craft, in order to visit the Pearl Oyster Nursery, and to deliver the instruments and instructions respecting the aquaria to Captain Phipps. Dr Cleghorn, the Conservator of Forests, with the permission of Sir William Denison, is to meet me at Palamcottah, and to travel with me, by way of Travancore, to the Neilgherry hills.

IX. Report on the Cultivation of Cinchona at Darjeeling during the month of November 1865, from T. ANDERSON, Esq., M.D., Superintendent Botanic Gardens, and in charge of Cinchona cultivation in Bengal, to the Junior Secretary to the Government of Bengal.

I have little to report this month beyond the usual steady increase in the number of plants, and the continued good condition of the plants. The increasing cold, accom-