AN HISTORICAL GEOGRAPHY OF THE NILGIRI CINCHONA PLANTATIONS, 1860-1900

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Abstract

In 1859, the British government launched an expedition to South America with the aim of collecting seeds and plants of the quinine-producing cinchona tree for establishing plantations in British India, so as to relieve the British Government of the escalating costs and uncertainties in the supply of this valuable, and increasingly popular anti-malarial drug.

Drawing on recent work on the commodities of empire, tropical acclimatization, and imperial medicine, this thesis provides a detailed study of the first British cinchona plantations established on the Nilgiri Hills of Southern India. Focused on the period between 1860 and 1900, and at the local geographic scale, the research critically examines the engagement and connections between government officials, planters, venture capitalists, labourers, plant material and ideas in the context of the cinchona plantations through a thorough study of archival and secondary sources. Contributions are also made to the study of the spaces of science and the management of the tropical environment. Cinchona is placed in a wider context of the history of botany and plantations in the Nilgiri region, and the major events in the development of cinchona plantations described.

In the resulting historical geography the Nilgiri cinchona plantations emerge as a 'nodal' point in the global cinchona network that also relied upon global networks of imperial power, capital and leisure tourism. The experiment was essentially an exertion of power but one that also demonstrated the very vulnerable nature of the empire.

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Glossary

burgher a racial category that includes descendants of Europeans and those of mixed race.[1]

cascarilleros South American bark collectors.

Collector British revenue officer, in charge of revenue and general administration.[2]

cooly/ie an estate labourer.

coolie lines a division of the labour force on an estate into living quarters of smaller groups.

ghat a mountain pass or mountain range.

godowns a warehouse or other commercial building used for the storage of goods.

kangany recruiter and supervisor of labourers.

maistry artisan, or native engineer, employed by the government (Sutton, 2009), and also a recruiter of labourers (as *kangany*).

mund seasonal and permanently occupied habitation site of the Todas, a Nilgiri hill tribe.

patta lease document for agricultural land specifying the position, land held, the classification of land, the name of the *pattadar* and the assessment to be paid for the land (Sutton, 2009).

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[1] For more on the complexities of the 'burgher' category see Duncan, 2007:18-19.
[2] A list of Collectors of the Nilgiri District can be found in appendix C. Before 1882 the same role was termed 'Commissioner'.

palanquin a wheelless vehicle, usually for a single person, consisting of a covered boxlike litter which is carried by means of poles resting on the shoulders of several men, formerly used in India and other Eastern countries, and similar to a sedan chair.

pattadar holder of a *patta.*

peon labourer.

shikari Indian game hunter.

shola(h) indigenous forest, a composite description of a woodland type which included trees, ferns, mosses, etc (Sutton, 2009).

taluq/taluk revenue sub-district.

Abbreviations

For further details of the archival collections consulted see appendix D.

AAR	Annual Administration Report of the Madras Cinchona Department found within the MRMC and located at RBGK.[3] These are, unless otherwise stated, authored by the Superintendent of Cinchona Plantations, Madras.[4]
BL	British Library, London.
BLO	Bodleian Library, Oxford.
BPP	British Parliamentary Papers.[5]
CN	Cinchona Notebook, part of the CRM collection and held at the RGS.
CRM	Clements Robert Markham Collection, held at the RGS.
CRMD	Clements Robert Markham's Diary, part of the CRM collection held at the RGS.
CUL	Cambridge University Library, Cambridge.
DC	Director's Correspondence, held at RBGK.
DRO	Derbyshire Record Office, Matlock.
EIC	East India Company.
GO	Government Order.

[3] In addition to annual reports, monthly updates for the Nilgiri plantations were issued from July 1861 to December 1866, and half-yearly reports issued between December 1866 and July 1876. These were all published in the BPPs.
[4] A list of Superintendents is provided in figure 7.1.
[5] Page numbers given for direct quotations from the BPPs are those written paginations on the volumes themselves, rather than those assigned by the digitizing process.

IEPC	India Economic Products: Cinchona, held at RBGK.
ILN	*Illustrated London News.*
JEH	John Eliot Howard Collection, held at RBGK.
LMA	London Metropolitan Archives, London.
MMD	Minna Markham's Diary, part of the CRM collection held at the RGS.
MRMC	Miscellaneous Reports: Madras Cinchona, held at RBGK.
MSCN	Manuscripts and Special Collections, University of Nottingham.
NAS	National Archives of Scotland, Edinburgh.
NCA	Nottinghamshire County Archives, Nottingham.
NPA	Nilgiri Planters' Association.
NWPA	Nilgiri-Wynaad Planters' Association.
ODNB	Oxford Dictionary of National Biography.
RBGK	Royal Botanic Gardens, Kew.
RCS	Royal Commonwealth Society Collection, held at CUL.
RGS	Royal Geographical Society, London.
RHBGO	Reports on the Horticultural and Botanical Gardens, Ootacamund. Unless otherwise stated, these are authored by William McIvor.

SIO	*South of India Observer*, held at the BL.
TNA	The National Archives, Kew.
UPASI	United Planters' Association of Southern India.
WL	Wellcome Library, London.

1 Introduction

1.1 The British Cinchona Experiment, 1860-1900

This thesis explores the establishment and working of cinchona[6] plantations on the Nilgiri Hills[7] of South India. The bark of the cinchona tree has long been used as a treatment for fevers owing to the presence of 25 closely related alkaloids, the most important of which are quinine, quinidine, cinchonine, and cinchonidine (Tyler *et al*, 1988),[8] the alkaloid content varying greatly within species. Following the isolation of quinine in 1820, proper dosage regimes were established (Greenwood, 2004), and new investigations made it possible to correlate alkaloid content with species, greatly enhancing the quality of the products available, and the opportunities for cultivating cinchona bark on a commercial scale. The manufacture of the bark's alkaloids was undertaken at once by T.N.R. Morson in 1821 in London, and two years later by the chemist Luke Howard.[9]

In 1859, under the leadership of Clements Robert Markham,[10] an expedition was launched to procure cinchona plants and seeds from their native South America with the intention of establishing plantations in British India. This thesis tells the story of this experiment and examines its wider context and implications for the empire and the individuals involved.

The time frame for the investigation is 1860-1900, from the year cinchonas gathered on the 1859-60 expedition first arrived on the Nilgiris, to the onset of widespread decline among the South Indian cinchona plantations as planters shifted

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[6] The modern spelling of cinchona (apparently resulting from a mistake by Linnaeus when he named the tree) is used throughout except for direct quotations where the original spelling is retained. Markham campaigned for the 'chinchona' spelling to be adapted (see Markham, 1874) but this was without success.

[7] The modern spelling of Nilgiris (as opposed to Neilgherries) is used throughout this thesis except for direct quotations where the original spelling is retained. Both spellings were in common usage throughout the study period.

[8] All published material is referenced within the main body of the text with full details provided in the bibliography (appendix E), whilst footnotes are reserved for manuscript archival material and explanatory notes. One exception is the British Parliamentary Papers (BPP), which, although published, has been treated as an archival source owing to the nature of the material contained within them (predominantly correspondence).

[9] Luke Howard is also credited with naming the clouds (see Hamblyn, 2001), and was the father of John Eliot Howard who later became tightly involved with the British cinchona project, acting as official Quinologist for the analysis of government bark.

[10] At the time Markham was a 29-year-old clerk at the India Office. He would later find fame as a geographer. See appendix B for a short biography of Markham and of other notable individuals in the experiment, and for a more comprehensive account see Markham, 1917.

to the cultivation of tea. This is also a period covered in some depth by available documentation in the archive (see chapter 3).

1.2 Cinchona 'Missions'

The British venture was not the first cinchona 'mission'. Spanish botanists had been the first to be commissioned to study the cinchona tree, and were followed by representatives from other countries including; the Frenchman La Condamine (expedition 1735-45),[11] whose 1738 monograph *Sur l'arbre du Quinquina* contained the first clear and detailed illustration of the cinchona (see Lee, 2002), the Spanish duo Ruiz and Pavon (collecting 1778-1788), Spanish priest, physician and naturalist Mutis (collecting missions 1761-1808), Caldas from the Botanical Institute of Bogota (collecting 1802-1816), Humboldt from Prussia (expedition 1801-1802), Weddell from France (1845-47 and 1851-52), and Hasskarl from the Netherlands (collecting 1853-54), culminating in the British expedition of 1859-60 led by Markham, Richard Spruce and Robert Cross[12] (see below).

All previous expeditions informed the British mission in one way or another, and those led by Weddell and Hasskarl[13] were launched in the same vein as the British mission, as attempts by the French and Dutch Empires respectively, to secure their own supplies of cinchona to be grown in their colonies, at a time of imperial expansion, and when the reputation of quinine in treating fevers was growing. The Spanish, naturally, were vehemently against such plans, fearing the end of their monopoly (Rocco, 2004). Pavon's work was particularly influential on the British. After receiving cinchona material collected in 1804 and 1805, Pavon revised the material and provided names and descriptions of numerous new species. "Pavon never published his work, however, but rather sold both the collections and the manuscripts... it was not until J.E. Howard acquired Pavon's manuscript and provided it with illustrations[14] that Pavon's revision was eventually published" (Andersson, 1998:3). Markham similarly rescued Mutis' cinchona manuscripts (King, 1876), which had lain hidden in a shed at the botanical gardens of Madrid.

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[11] "Ostensibly the prime aim of the expedition was to measure an arc of the meridian at Quito in Ecuador to determine the shape of the earth" (Lee, 2002:191). The cinchonas Condamine managed to gather were swept overboard in the Amazon.
[12] Dates of expeditions are taken from Gramiccia, 1987a:8.
[13] See Goss, 2004:81-82 for more on Hasskarl's expedition.
[14] See Howard, 1862.

Livingstone describes how, "...in the museum people learned how to view the world, how to value the past, and how to visualize the relationships between specimens" (2000b:290).

Although Weddell was credited with achieving the first partial success in cinchona cultivation outside of South America when the seeds he'd gathered in 1849 successfully germinated in Paris, London and Holland,[15] the French largely failed in their efforts to establish viable plantations in Algeria, the climate being apparently too dry (Lee, 2002), leaving the British and Dutch teams to lead the cultivation.[16] Weddell attempted to clarify the mystery surrounding the species and varieties of the tree listing 21 species in his classification. However, in 1867 Markham listed 143 species of cinchona in New Granada alone, and in a new revision of his classification from 1871, Weddell increased his number of recognised species to 35. The difficulties of classification are owing to the nature of the plant itself:

> Due to the position of the 5 anthers at a lower level than the stigma in the flower of the cinchona self-pollination is practically impossible. The almost exclusive cross-pollination produces large numbers of hybrids or varieties, each of which is very sensitive – and adapt better than others – to relatively small ranges of altitude, climate, nature and conditions of the soil. Therefore, in each relatively small section of the 3,000km range of latitudinal distribution of cinchona in the eastern slopes of the Andes, one finds groups of better adapted varieties – and not others – that remain themselves subject to a continuous process of cross-pollination and natural selection over others (Gramiccia, 1987a:9).

The latest attempt at a revision of the genus by Andersson (based on the study of herbarium collections) considered 330 names, "with little hope that all the variety-level names have been dug out" (1998:2), and eventually recognised 23 species, three of which were new to science.

The three dominant species featuring in this story are *Cinchona succirubra*[17] (and its hybrids), known in commerce as 'red bark', *Cinchona calisaya* (including *calisaya ledgeriana* and hybrids) referred to in commerce as 'yellow bark', and *Cinchona officinalis* (known commercially as pale or crown bark).

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[15] A young tree derived from this seed was sent to Java and became the foundation of the Dutch plantations.
[16] Cinchona had a much earlier presence in Britain; Evelyn recording in his diary entry for August 7th 1685 that he had been to see Jesuits bark in the Apothecaries Garden at Chelsea (see Anon, 1930a).
[17] Latin meaning red juice, (Tyler, Brady and Robbers, 1988).

Figure 1.1 - *Cinchona succirubra, officinalis,* and *calisaya*

Source: From left to right: *Cinchona succirubra* by W. Fitch from Howard, 1862. Wellcome Images, *Cinchona officinalis* after Burnett, M.A. (c. 1842). London: Whittaker & Co. Wellcome Images, and *Cinchona calisaya* from: http://www.botanical.com [Accessed on 16/01/10].

1.3 The Nilgiris

Concurrent British cinchona experiments were conducted elsewhere in India (principally on government owned plantations in Darjeeling), and in other colonies including Ceylon and Jamaica. Other European empires also experimented with the tree's cultivation, notably the Dutch in Indonesia. The geographical focus for this study is, however, focused on the Nilgiri Hills, and is centred upon the British settled town of Ootacamund, South India's most famous hill station. The Nilgiri region has been selected because it was the chosen destination for the first British cinchonas, and arguably became the administrative and operational centre for the wider experiment, providing plants, seeds and expertise for other cinchona sites. Perhaps best termed a central node in what rapidly became a global network, the Nilgiri team became the authority on cinchona, although this was not without challenge and obstacle.

1.4 Aims and Objectives

The main aim of this study has been to produce a history of the British cinchona experiment, through an examination of the establishment and operation of plantations in the Nilgiri region of South India. Whilst links are drawn between cinchona and other plantation crops of empire, important distinctions also become apparent. The local geography and particularities of the study site make this research unique among other works on the history of cinchona and malaria, whilst the medicinal properties of the cinchona bark mark out its uniqueness amongst studies of empire agriculture. The objectives are to describe the environment and chronology of the Nilgiri cinchona experiment, to evidence the broader links to networks of science, production, and knowledge, and to explore the management of labour, climate and environment on the cinchona plantations.

This case study builds on recent scholarship on the spaces of science to illustrate that place was important in the production of knowledge on the cinchona tree, and on a more fundamental level shows that the cultivation of cinchona was a project involving scientific investigation. The experimental nature of the management of the plantations, involving labour and the environment is also explored. The survival of populations and the British Empire itself was thought to depend on the experiment's success. As such, cinchona is conceptualised as a 'commodity of empire' and as one in a long line of plant-transfers facilitated to a large extent by the imperial botanic garden network. This history necessarily also considers the wider histories of the cinchona tree, malaria, the Nilgiri region, and of the individual characters involved.

1.5 Outline of Chapters

Chapter 2 contextualizes the cinchona experiment by reviewing literature on three distinct yet interrelated themes; commodities of empire, acclimatization and tropicality, and the history of medicine. These bodies of literature inform the study, and the themes reappear throughout the study.

Chapter 3 then examines the 'cinchona archive' and its geography in a number of institutions notably the RBGK and the RGS, before outlining the methods employed and highlighting the wide ranging nature of the published and manuscript sources which have been drawn upon to tell this story. The benefits and drawbacks of each source are also acknowledged.

The geographical focus of the experiment is the subject of chapter 4, which documents the history of the British occupation of Ootacamund and the Nilgiris, and the long association of the hills with botany and plant acclimatization, setting the scene for the arrival of cinchona in 1860. The development of the Government Gardens under the Superintendency of William Graham McIvor, who trained at both the Royal Botanic Gardens at Edinburgh and the RBGK, emerges as a key event in the selection of the Nilgiris as the site for British cinchona plantations. The progress of industrial planting on the Indian Hills is explored in the final section, the history of tea and coffee in the region being particularly essential to an understanding of the place cinchona plantations occupied.

Chapter 5 essentially tells the story of the cinchona experiment, from its planning in the 1850s, to the progress and setbacks of the 1860s, and the cinchona boom of the late 1870s, to accusations of neglect and the appointment of a new Superintendent in the 1880s, to the on-site factory production and rapidly diminishing investment in Nilgiri cinchona plantations experienced during the 1890s. Fluctuating fortunes become apparent, the cinchona planters reliant upon events at both the world and local scales for success.

Spaces of cinchona science are the subject of chapter 6. Four dominant spaces of science formation and negotiation are taken in turn; the garden, plantation, laboratory/factory, and the more abstract print space, and the role of each in creating and disseminating local and universal cinchona science is explored. Specific scientific debates are used to illustrate the wider range of activities which took place at each site.

Chapter 7 is an exploration of cinchona management. Labour was an essential component of the cinchona experiment and this chapter begins by determining the labour hierarchy in operation on the plantations, and the management strategies employed at each stage are then explored. Shortages of labour were experienced at various stages of the project, and the government plantations utilised members of the indigenous hill tribes, imported Indian labour from the plains, and convict labour from China and the Straits Settlements, each of which presented its own challenges to management. The activities to be performed during the 'cinchona year', are then identified before the obstacles that the natural environment presented; in the form of inclement weather, pests, and disease, are discussed in terms of their own roles in the development and outcome of the cinchona project.

The thesis is drawn to a conclusion in chapter 8, where findings are discussed in relation to the broader themes identified in chapter 2, and the contribution to historical geographical scholarship summarised.

2 Contextualising the Cinchona Experiment

This chapter establishes the historical context which surrounds the British cinchona transfer, in terms of dominant theories of tropical environments, medicine and disease, and also places this thesis in its contemporary context, at a time of renewed enthusiasm for commodity histories and explorations of botany and empire.

2.1 Commodities of Empire

Commodities are back in the news
(Hazareesingh and Curry-Machado, 2009:1).

In the Editorial to a recent special issue of the *Journal of Global History* dedicated to 'Commodities of Empire,'[18] Hazareesingh and Curry-Machado (along with other members of the 'Commodities of Empire' (hereafter CoE) research collaboration),[19] outline their belief that now is perhaps, "...an appropriate moment for revisiting the social histories of commodity production, transactions, and consumption" (2009:2).

Emphasising the 'social' elements of a commodity's history has been a common strategy for tackling what are often huge and complex stories, inevitably involving human agency. A social relationship is indeed inherently implied in the cultural, economic and political process through which components of the physical world become named and regulated as 'commodities' (see Appadurai, 1986). Hazareesingh and Curry-Machado elaborate, "Historically, commodities had multiple social lives, partaking both in imperial endeavours and in local resistance to them," their transformations bound up with, "...social changes over vast geographical areas, in infrastructures, technologies, economies, ecologies, labour regimes, and patterns of migration and consumption" (2009:2). This perhaps helps to explain why a large number of 'commodity histories' have been written by anthropologists (see below), with geographers notable only through their absence.

[18] *Journal of Global History* (2009). 4.
[19] Commodities of Empire is a joint research collaboration between the Open University's Ferguson Centre for African and Asian Studies and London Metropolitan University's Caribbean Studies Centre and is funded by the British Academy. See: http://www.open.ac.uk/Arts/ferguson-centre/commodities-of-empire/index.html. [Accessed on 16/01/10].

Beinart and Middleton highlighted the growing popularity of commodity stories in their review of work on plant transfers:

> The socio-economic history of particular crops, and the agrarian complexes which grew up around them, have attracted illuminating studies: Salaman on potatoes; Mintz on sugar; Miracle on maize in Africa...'Biographies' of plants that became important commodities, such as the tulip and coffee, are multiplying. Allowing coverage of both natural and social history, this genre is linked to popular interest in the history of science (2004:10-11).

The 'mother of the genre' is Jacob's (1935) *Coffee: The Epic of a Commodity*, the first in a series of inter-war and post-war publications of its sort, prompted by continuing concerns surrounding the security of supply of basic foodstuffs and industrial materials, rationing and de-rationing (completed in 1954 in Britain), and the renewed attention upon empire foodstuffs throughout Europe. As Hill reflected in the British context:

> The impact of a second World War has served to bring home more forcibly than ever the dependence of our modern civilization on plants and plant products. Once normal sources of supply were cut off and the exigencies of the war brought about an increased demand, many fibres, oils, fats, insecticides, and drugs, as well as rubber, were quickly classified as strategic materials... Where foreign plants were concerned, attention was usually directed to the possible introduction and establishment of these species in the Western Hemisphere (Hill, 1952:*v*).

Jacob, a German poet, novelist and journalist, contravened a Nazi ban on his work to publish the documentary novel on coffee, and the publication of *Six Thousand Years of Bread* in 1944 established his expertise in the field. The new trend continued with British pathologist and geneticist Redcliffe Salaman's[20] (1949) *The History and Social Influence of the Potato*, and the sugarcane technologist Noel Deerr's (1949-50) two-volume work on sugar.

After a period of relative quiet, commodities were back on the literary agenda in 1985 with the publication of anthropologist Sidney Mintz's *Sweetness and Power*. Here Mintz explicitly linked sugar to Britain's colonial strength. As a calorific and

[20] For more on Salaman see Smith, 1955.

low-cost food substitute, sugar grown on the slave plantations produced the fuel to keep the laboring classes of the empire going.

From the 1990s onwards, studies of commodities have proliferated. Tales of how the world's great articles of trade came to occupy their present positions commonly examine the relations between production and consumption, and nature and culture, often-constituting popular reading, rather than strictly academic enquiries. The American journalist Mark Kurlansky has dominated the market with, amongst numerous others, studies of cod (1997), and salt (2002). Kurlansky's subject choices stand out in a vast genre that usually favours plant-based commodities.[21]

The mutually reinforcing relationship between 'commodities' and 'empires' is well established. As the CoE project's own introduction outlines:

> Empires have historically fostered the political, communication, legal, and military infrastructure necessary for both local commerce and long distance trade, and amassed wealth from these transactions through taxation, customs duties or the creation of state monopolies. The flow of commodities – understood as products of value intended for exchange – has been central to the propensity of most empires (CoE website).

Many commodities with connections with empire now have several dedicated histories. Table 2.1 shows a small selection of these works. The public appear to be preoccupied by a desire to know the history of some of our most indispensable ingredients in an era of renewed awareness of the importance of ethical consumerism (especially when it comes to food), often combined with an apologetic stance concerning the past activities of the great empires. Many of these works emphasise their global scale and approach, so as to illustrate the importance of these goods to society as a whole.

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[21] Other exceptions include Shah, 2004 on oil and Freese, 1995 on coal.

Table 2.1 – Recent Commodity Histories with Connections to Empire

Commodity Type	Commodity	Book Titles and Authors[22]
Beverage Crops	Tea	- Moxham (2003) *Tea, Addiction, Exploitation and Empire* - Macfarlane and Macfarlane (2004) *Green Gold: The Empire of Tea* - Griffiths (2007) *Tea: The Drink that Changed the World*
	Coffee	- Allen's (2001) *The Devil's Cup: Coffee, the Driving Force in History* - Prendergrast (2001) *Uncommon Grounds: The History of Coffee and How it Transformed the World* - Wild (2005) *Coffee: A Dark History*
	Cocoa	- Coe and Coe (2003) *The True History of Chocolate*
Luxuries and Stimulants	Alcohol	- Unwin (1991) *Wine and the Vine: An Historical Geography of Viticulture and the Wine Trade* - Coulombe (2004) *Rum: The Epic Story of the Drink that Conquered the World*
	Sugar	- Macinnis (2002) *Bittersweet: The Story of Sugar* - O'Connell (2004) *Sugar: The Grass That Changed the World*
	Spice	- Milton (1999) *Nathaniel's Nutmeg* - Willard's (2001) *Secrets of Saffron: The Vagabond Life of the World's Most Seductive Herb* - Rain's (2004) *Vanilla: The Cultural History of the World's Favourite Flavour and Fragrance*
	Tropical Fruit	- Scott-Jenkins (2000) *Bananas: An American History*
	Flowers	- Dash (2000) *Tulipomania: The Story of the World's Most Coveted Flower and the Extraordinary Passions it Aroused*
Rubber and Textiles	Rubber	- Loadman (2005) *Tears of the Tree: The Story of Rubber a Modern Marvel* - Jackson (2008) *The Thief at the End of the World: Rubber, Power and the Seeds of Empire*

[22] Full references can be found in the bibliography – appendix E.

	Textiles	- Cohn (1956) *The Life and Times of King Cotton* - Farnie and Jeremy (Eds). (2004) *The Fibre That Changed the World* - Yafa's (2005) *Big Cotton: How a Humble Fibre Created Fortunes, Wrecked Civilisations and Put America on the Map*
Dyes	Indigo	- Balfour-Paul (1998) *Indigo*
	Cochineal	- Greenfield (2005) *A Perfect Red: Empire, Espionage, and the Quest for the Colour of Desire*
Drugs	Tobacco	- Dickinson (1954) *Panacea or Precious Bane* - Gately (2001) *La Diva Nicotina: The Story of How Tobacco Seduced the World*
	Opium	- Booth (1998) *Opium: A History*
	Quinine[23]	- Honigsbaum (2001) *The Fever Trail* - Rocco (2003) *The Miraculous Fever-Tree*

Indeed there are now a number of publications tracing the histories of the plant commodities deemed to have most 'changed the world.'[24] Bertha Dodge[25] set the shape of things to come. In *Plants that Changed the World* (1962), Dodge dedicated chapters to the collection of the breadfruit, cacao, cinchona, chaulmoogra (a treatment for leprosy), rubber, abacá fibre (for rope), carnauba wax and its alternatives, and the arrow poison curare. The medical potential of plants was the topic of Taylor (1965), which recounted the intriguing discoveries of thirteen plants (or groups of plants) with medicinal properties (from coca and opium to mandrake and willow) that revolutionized the treatment of an array of diseases. Hobhouse was next to contribute to the genre, and became the most commercially successful with his pairing of *Seeds of Change: Five Plants that Transformed Mankind* (1986) with chapters on quinine, sugar, tea, cotton and the potato, (later extended to six with a chapter on coca in 1999), and *Seeds of Wealth: Four Plants that Made Men Rich* (2003), which looked at the histories of four plants (timber, wine, rubber and tobacco) that resulted in huge financial gain for certain individuals and nations through the

[23] The history of writing about quinine and cinchona are tackled in more detail in section 2.3.4.
[24] A 2005 *Guardian* comment page article by Richard Adams suggested that these "overinflated" claims in book titles revealed a "lack of self-confidence among publishers", noting that most things that exist could be seen to have "changed the world". The article provides a brief history of the trend, which Adams traces back to Dodge. I too would guard against exaggerating the role of any of these commodities, including cinchona and quinine.
[25] Dodge also authored volumes on cotton (1984), spices (1988) and potatoes (1970).

development of large scale industries. Seeking a causative role for plants in human history, Hobhouse explains that with the opening up of the world, "mineral discoveries were exploited at once, but more vital, in the long run were plants; not surprising, really, since plants grow, while exploited minerals diminish" (2003:125). The most recent addition comes from Musgrave and Musgrave (2000), in which they present the histories of seven plant products; tobacco, sugar, cotton, tea, opium, quinine and rubber alongside the high action adventures of the men involved in their commodification, all set in an imperial context.

Returning to academic scholarship, recent work emerging from the CoE project has included papers on; the connectedness of port cities within the British Empire (Hazareesingh, 2007), the impact of the introduction of steam machinery to Cuba's sugar industry (Curry-Machado, 2007), the relative positions of power between the Bengali and Piedmontese silk industries (Davini, 2009), clashes between national and imperial interests in the palm oil sector of Nigeria (Olukojo, 2008), and the promotion of empire foodstuffs (particularly the ingredients of the Christmas pudding) in Britain (O'Conor, 2009a). The 2009 project workshop[26] included papers on a diverse range of commodities from rubber to whale oil and India Pale Ale. Members see the most important contribution of the collaboration as having been to recognize the agency "in all its complexity, unevenness, and contradictions of those living in the colonized spaces of the world" (Hazareesingh and Curry-Machado, 2009:5).

2.1.1 Ecological Imperialism

In explaining the distribution of European man around the world, Crosby (1986) attributed success to the superior adaptive and colonising power of European plants, animals and disease pathogens. Crosby took environmental history in a radical new direction, and awarded plants explicit agency in empire building. In North America, Crosby's champions were white clover and the Eurasian plant now known ironically as 'Kentucky Bluegrass', native floras were unable to resist the onslaught of the European invaders.

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[26] 'Power and Resistance within Commodity Chains, 1800-2000', the Third Annual International Workshop of the Commodities of Empire Project, was held at the Open University, Camden Town, London on 29th June 2009.

Of the Non-European plants that made it to Europe, Crosby commented that they, "...usually pined away and died unless given special quarters and pampering at such homes for exotica as Kew Gardens... " (1986:166). He concluded that, as "weeds thrive on radical change, not stability" (1986:170), transported European flora (most often arriving unintentionally in the early years of colonisation) acted to heal the newly colonised and disturbed land, in addition often becoming essential feed for European livestock which in turn fed the European man, contributing further to their great success. "People spoke (quite independently of specifically Darwinian ideas) about European plants and animals, more 'fit' in the 'struggle for existence' than the 'primitive' creatures of these 'early' lands" (Dunlap, 1997:318).

However, Crosby's asymmetrical pattern of plant exchange has not escaped critique. As Beinart and Middleton explain:

> Even in the period from 1500-1900, plant transfers may have been more evenly balanced than Crosby suggests. Ships sailed both ways and from the earliest phases of European expansion there was a significant wash back... If a wider range of food and useful plants, rather than a few staples, is taken into account, and a global rather than European perspective adopted, then plant flows may look more multi-directional... A longer timescale may raise further doubts (2004:8).

Still the idea of ecological aids to empire expansion remains a useful contribution. In 1981, Headrick attributed much of the successful imperial expansion to a number of key technologies or scientific advances which he termed the 'tools of empire'. Technical innovations in weaponry (gunboats), communications (the telegraph), and transportation (steamships), stand alongside one ecological tool – quinine, but in this case it is the scientific advance which isolated the quinine alkaloid and improved the efficiency of the medical treatment which is the primary focus, rather than the inherent empire building qualities of the plant.[27] In 1983 Lucile Brockway spoke specifically of "plant imperialism", highlighting the "subterfuges and downright illegalities" (1983:32) practiced by the Kew collectors in their deceit of national authorities, particularly in the cinchona and rubber transfers.

[27] Headrick went on to explore the implications of these technology transfers in terms of long-lasting underdevelopment for the colonial regions (see Headrick, 1988).

Grove returned to Crosby's ideas in 1995 to trace the emergence of environmental thinking to the colonial periphery, and the starring role of nature in imperialism was once again brought to the fore by John MacKenzie in 1997, where, in a similar vein to Grove, he linked the imperialist preoccupation with hunting to the emergence of conservation and environmentalism.[28] His contention that, "Empires of nature are deeply embedded in the nature of empires" (1997:22), is central to this thesis.

2.1.2 Colonial Botany and the Botanic Garden Network

In their edited volume of the same name, Schiebinger and Swan define 'colonial botany' as, "...the study, naming, cultivation, and marketing of plants in colonial contexts", which was, "born of and supported European voyages, conquests, global trade, and scientific exploration" (2005:2). They contend "There are as many sorts of colonial botany as colonies, in the sense that different state structures or companies deployed or produced differing modes of scientific practice" (2005:6). The rise of economic botany in the nineteenth century saw many plants transformed from local subsistence products to the subjects of global trade as colonial capitalism became embedded as the world financial system.

Grove (1995) describes how the Portuguese established a system of acclimatization gardens during the course of the fifteenth century, on Madeira, Sao Tome and Fernando Po, which enabled them to carry out a complex series of plant transfers. From the late sixteenth century onwards, apothecary gardens were beginning to undergo the transition from being simply repositories of plant material for medical use to cultivated gardens. Early colonists encountered a huge variety of plants that soon became too extensive to confine to a single botanical garden and thus the "whole tropical world became vulnerable to colonisation by an ever expanding and ambitious imaginative symbolism" (Grove, 1995:5). Numerous 'Edens' were discovered, catalogued, and (where possible) sent home. "The sixteenth century voyagers ransacked the world, taking back whatever seemed interesting or profitable – plants, animals, even native peoples" (Dunlap, 1997:304). Moving into the seventeenth century, agricultural innovation was increasingly closely associated

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[28] MacKenzie focuses on the Scottish contribution to the British Empire and it is worth noting that many of the British Empire's botanists were Scottish, where medical training included the study of botany.

with a growth in empirical botanical knowledge and an interest in the transfer of crop plants from one country to another (Grove, 1995 and Thirsk, 1985). The Dutch set up a garden in Capetown in 1694, the French in Mauritius and in the early part of the eighteenth century the English established gardens on Jamaica and St Vincent as well as in Calcutta and Penang (Grove, 1995).

In considering the history of the RBGK, Lucile Brockway (an anthropologist by training) highlighted the shift in pace and strategy in plant transfers that came with the age of formal empire:

> Anonymous diffusion continued, but European governments, chartered trading companies, and private industry made a conscious effort to collect useful plants. Botanic gardens were established or enlarged to receive, nurture, classify, and tranship exotic plants. By mid-nineteenth century they had acquired the technical ability to improve and adapt plants for commercial production (1979a:37).

In 1997, McCracken widened this focus to include the whole network of botanic gardens in the British colonies. Tables 2.2 and 2.3 show how gardens in India were considered to be of particular importance.

As McCracken explains, "By 1901, gardening was more than just a pastime. It was an adjunct to imperialism, and the 100 or so British colonial botanic gardens in existence were as much a part of British imperialism as were the fleets of the Royal Navy or the soldiers of the Queen" (1997:*x*). Underground posters invited Londoners and tourists to take a tour of the wealth, romance and beauty of the empire at Kew Gardens (Gilbert and Driver, 2000); offering a glimpse of the exotic and infinitely fascinating plant life of countries that, for most people, there was still little hope of visiting. "Kew's popularity with the public was evident from the start" (Brockway, 1979a:81) and the greenhouse plants were of special intrigue amongst the general public (Hepper, 1982). Plant transfers became central to Kew's mission after William Hooker established the Museum of Economic Botany in 1848.[29] Of numerous titles on Kew, Desmond's[30] *The History of the Royal Botanic Gardens Kew* (1995, revised 2007) is the most comprehensive account of the garden's structure,

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[29] See Griggs *et al.*, 1998 for more on the Museum of Economic Botany.
[30] Desmond was formerly chief archivist and librarian at the RBGK.

staff and activities over the last 200 years. For Drayton (2000), the rise of the gardens at Kew becomes central to his investigation of the 'improvement' of the world through the application of science and botany in particular to imperialism. Endersby (2008) analyses Joseph Hooker's (1817-1911) career (much of it spent as Director of Kew) to explore the development of Victorian science considering the reception of Darwinism, the consequences of empire, and the emergence of the professional botanist.

Table 2.2 – Distribution of the 115 Recognisable British Imperial Botanic Gardens of the Victorian Era

Area	**Number of Gardens**	**Percentage of Total**
Australia and New Zealand	28	25
India, Ceylon and Burma	28	25
Africa	21	18
West Indies, Central and South America	21	18
Canada	7	6
Islands: Fiji, Mauritius, Seychelles, Malta and St Helena	5	4
Malayan Peninsula and Hong Kong	5	4
Total	**115**	**100**

Source: McCracken, 1997:19.

Table 2.3– Botanical Gardens and Stations in the Indian Empire, pre 1902

Country	Name	Date of Establishment
India and Burma	Alipore (Agri-Horticultural Society of India Gardens)	*c.* 1839
	Balasore	
	Bangalore Government Botanic Gardens (Lal-Bagh), Mysore	1819
	Calcutta Royal Botanic Gardens	1787
	Lloyd, Darjeeling	1878
	Mungpoo Government Cinchona Plantation	1862
	Seebpore	
	Cawnpore Experimental Station (North India Botanical Department)	
	Chittagong (Agri-Horticultural Society)	1838
	Lahore	
	Lucknow (North Indian Botanical Department)	
	Madras Agri-Horticultural Society	1835
	Madras Government Cinchona Plantation	
	Moulmein (Agri-Horticultural Society), Burma	
	Ootacamund, Nilgiris (Madras Botanical Department)	1847
	Oodeypore (Bombay Horticultural Gardens Department)	
	Poona, Ganesh Khind Ghorpuri (Bombay Horticultural Gardens Department)	
	Dapurie	1828
	Heura	
	Rangoon (Agri-Horticultural Society), Burma	*c.* 1886
	Saharanpur Government Gardens (United Provinces of North India Botanical Department)	(1779) 1817
	Samalkot	*c.* 1780
	Serampore	*c.* 1799
Ceylon	Peradeniya	1821
	Hakgala	1860
	Heneratgoda Botanic Gardens, Gampaha	1876
	Anuradhapura	1883
	Badulla	1886

Source: McCracken, 1997:212-213.

In the early years of empire, "Many important plant sources changed hands through the vagaries of European politics" (Brockway, 1983:34),[31] but the situation became very different when in the nineteenth century, Europeans decided that they wanted certain Latin American plants, which now 'belonged' to newly independent nation states (Brockway, 1983), and certain species of the exuberant vegetation of the East Indies (Crosby, 1986, Brockway, 1979a and 1979b). Brockway explores the cinchona, rubber and sisal transfers in detail. 'Exotic' flora and fauna soon became reclassified as treasures of empire, subject to exploitation and transfer for monetary or health return. Imperialist adventure and botanical science were mutually constitutive: the leading figures of the time, "felt no conflict between the pure aspects of their science - extending their knowledge of the world's flora, its habits of growth, its geographical distribution - and the application of this knowledge to enrich the Empire" (Brockway, 1979a:60). Exchanges were to have profound effects on entire populations through improved food supply, on world trade through the new plantation system (see below) and, on world dominion. Competition between the European powers acted to spur on plant development.

As botanical commodities and empires became mutually reinforcing, the professional plant hunter emerged. A number of publications focus upon their adventures (see Lyte, 1983 and Musgrave *et al.*, 1998). As Lyte explains, "Britain produced the most successful men in the field, because they were backed by the great botanic gardens of Kew and Edinburgh, the Royal Horticultural Society, nursery gardens and the wealthy patrons, and had the added advantage of the huge area of the British Empire in which to work" (1983:8). Schiebinger and Swan (2005) correctly assert that, "European botanists voyaging out to the colonies were a varied lot. Some were travelling missionaries; many were academically trained as physicians or apothecaries. A few paid their own passage; most were sent by trading companies, kings, or scientific academies" (2005:10).

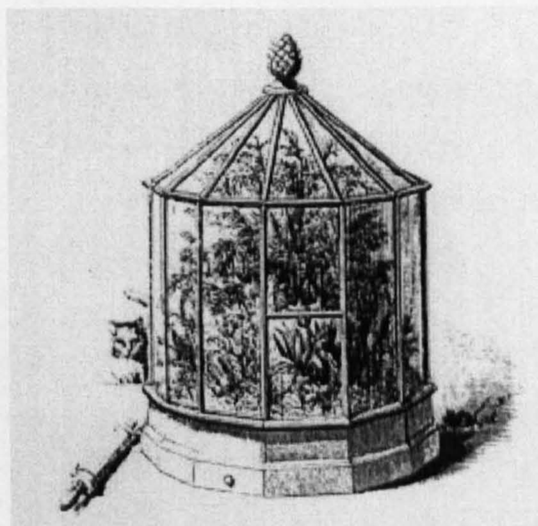
Mid-nineteenth century, better and faster ships gave rise to vastly improved survival rates for transported plants and animals, and, "What had been perilous and difficult became routine" (Dunlap, 1997:305). The Wardian case (figure 2.1) was

[31] Milton's (1999) history of nutmeg on the island of Run is a classic example of this.

invented in 1829 and revolutionised long distance plant transfer.[32] "Whereas in 1819 only one plant in a thousand had survived the voyage from China to England, in 1851 Robert Fortune shipped 16 wardian cases full of thousands of tea seedlings from Shanghai to Calcutta without significant loss, to start the Darjeeling tea industry" (Brockway, 1979a:87). The British geographer (and leader of the cinchona project) Clements Markham explained the endless nature of the opportunities and rewards,

> The distribution of valuable products of the vegetable kingdom amongst the nations of the earth – their introduction from countries where they are indigenous into distant lands with suitable soils and climates – is one of the greatest benefits that civilisation has conferred upon mankind. Such measures ensure immediate material increase of comfort and profit, while their effects are more durable than the proudest monuments of engineering skill (1862a:60).

Figure 2.1 – The Wardian Case



Source: Originally published in Ward (1852) and reproduced on David R. Hershey's website devoted to Nathaniel Ward:
http://www.fortunecity.com/greenfield/clearstreets/84/ward/dh321.html [Accessed on 16/01/2010].

Great Britain was now the leading industrial, commercial and colonial power in the world and could transfer plants at will.

[32] For more on Nathaniel Ward's case, see: Allen, 1975.

> As important as the physical removal of the plants was their improvement and development by a corps of scientists serving the Royal Botanic Gardens... New technical knowledge, of improved species and improved methods of cultivation and harvesting was then transmitted to the colonial planters and was a crucial factor in the success of the new plantation crops and plant based industries (Brockway, 1979a:6-7).

Cinchona was one of many plantation crops to be the subject of these improvement schemes.

2.1.3 Plantation Agriculture

As Brockway explains, it was the luxuries derived from tropical plants – "the non-essential foodstuffs that made a pleasurable addition to the diet, the dyes and fibres that had hitherto been available only through trade with the Arabs – that excited the imagination of European traders and governments, and fostered the plantation system in the new tropical colonies" (1983:32). Higman's (1988) *Jamaica Surveyed* is a comprehensive study of plantation settlement on the Caribbean island, capitalising on the availability of a remarkable collection of maps and plans, which document the internal layout of large agricultural holdings on an island where the plantation system (primarily sugar and in the latter nineteenth century coffee)[33] dominated, and entered the lives of the majority of the population in some way. As Higman explains, "The rapid growth of absentee proprietorship during the eighteenth century created a large group of wealthy individuals resident in Great Britain anxious to visualise their plantations and capable of paying the charges of professional surveyors and planmakers (as well as, sometimes, pictorial artists)" (1988:1).

In a study of landed estates and their owners in Georgian Britain, Seymour *et al.* (1998) similarly establish interconnections between the Caribbean and Britain through a case study of the management of the land labour and finance property of Sir George Cornewall (Moccas in Herefordshire and La Taste in Grenada). They explain that,

[33] Cinchona was also grown on Jamaica; see Spelman and Yesko, 2007.

> As members of the ruling elite and as individual proprietors, estate owners were involved with empire in a variety of ways: through colonial or military service by a member of their family, through investments or interests in colonial trade, through their commissioning of artists, writers and map makers to depict colonial landscapes or their own accounts of such places and through the direct ownership of colonial estates (1998:13).

Visual depictions of the Caribbean plantations of the Georgian period focused on the luxuriance and productive potential of tropical nature. "Such a view screened out controversies over slave labour and conduct, the dangers of tropical climates, sexual exploits on plantations and the fragility of the 'West Indian' society and economy" (Seymour *et al*, 1998:316). The study also outlines the vulnerability of the plantation. "The devastation of the Grenadan insurrection, exacerbated by a plague of rats and dry weather in 1797, contributed to uncertainty over the future of La Taste" (1998:333). Beliefs surrounding the slave body and character are also explored. "Medical supervision was regarded as important by planters, because of the incidence of fevers and other diseases in the tropics, the concern with fertility and racially based doubts about the maternal instincts of slave women" (1998:340).

Moving the story forward, Courtenay's 1965 economic geography of the plantation system outlines the changes that occurred as a result of events in the nineteenth century, namely the abolition of slavery and the advent of much improved communication channels in the form of the railways and steamship. The size of plantations also generally increased in an attempt to make operations more cost effective (resulting in the opening up of much of the inland tropics), and expenditure generally increased owing to the implementation of more processing machinery, giving rise in many cases to company control (often operating from a distance) superseding the individual proprietor (see Courtenay, 1965:45-48). Many of the plantation crops were interdependent, sugar used in conjunction with tea, coffee and alcohol, and jute used to package many plantation commodities.

Webb's (2002) study of nineteenth century Sri Lanka recounts the dramatic ecological transformation of the highlands, from isolated rainforest to plantation agriculture, in the form of coffee, cinchona and tea estates. Waves of disease played a decisive role in the succession of plantation crops.

> In the 1870s, the highland coffee industry was stricken by a tropical fungus. As the coffee plants withered and coffee yields fell dramatically, the highland estate managers turned their efforts toward cinchona. But in short order, the cinchona industry peaked and collapsed. From the 1880s onward, the tea plant proved itself both an economically and ecologically viable crop at all elevations on the island (2002:149).

Ultimately the ecological destruction of the highlands by the British tropical pioneers emerges, responsible for the massive loss of topsoil through full-scale forest burning and soil scraping.

Taking the same geographical focus as Webb, Duncan (2002) sees plantations essentially as microcosms of the European colonies and more specifically as laboratories of modernity in the colonial tropics in the mid-nineteenth century, markedly different from earlier slave plantations in the Americas. He asserts that, "Plantations can be conceived on as modern technologies for the reconfiguration of space, tools, scientific instruments and other material resources, bringing together culturally heterogenous populations, stripping them of their former social attachments and reconstituting them as workers through the use of space-time strategies of monitoring and control" (2002:317). In his 2007 monograph, Duncan documents not only the rise and fall of Ceylon's coffee industry between 1830 and 1880, but also the ineffective nature of colonial practices, particularly relating to labour reproduction on the estates. In highlighting the disciplinary methods employed by coffee planters on the island (namely constant surveillance and punishment), he places them alongside the methods of resistance (particularly 'everyday resistance') employed by plantation labour.

There is an acknowledgement of the difficulty he and others face owing to a lack of evidence within the colonial record of resistance by Indian labourers on plantations. In deciding to search for resistive practice rather than 'voice', Duncan engages with Scott's (1985) 'weapons of the weak', "...tactics used by people without the power to directly challenge those in authority" (Duncan, 2002:326). In attempts to minimize their input on the plantation, labourers developed a range of tactics to avoid work; covert strategies of feigning sickness, hiding themselves and harvested coffee, sabotaging machinery and stealing coffee, operated alongside the more risky overt strategies of insubordination (punishable by flogging), and desertion. To balance the investigation, the strategies of domination undertaken by the planters, in an atmosphere of increasing governmental pressure to restrict illegal beatings are also outlined. Those involved in labour recruitment (the *kanganies*) are depicted as occupying a 'middle space', showing only limited solidarity with either the planter or labourer. The work also provides information on the micro-geography (or 'abstract space') of the coffee plantation. Unusually high death rates characterized the migratory labouring population in Ceylon, and Duncan's study accordingly explores themes of heath, disease, medicine and the body in association with the supposed transformative power of the plantation.

Duncan answers Thomas and Eve's (1999) call to be more attentive to failure (personal and systematic), through awarding power to all actors, including the tropical environment and disease, and in so doing adds an ecological dimension to the study of colonial governmentality. Kumar's study of indigo plantations in colonial India, 1860-1913, however, reminds us that failure is not the only outcome of experiments in plantation agriculture. Kumar establishes plantations as important sites of science and development, and in so doing, recovers, "planters and their indigo science from the obscurity into which they have fallen since the transition to synthetic colourants" (2007:5).

In the nineteenth century, tropical plantation crops became one of the main sources of wealth for the empire, with the key transfers taking material from regions of abundant land but scarce labour (South America) to areas of abundant labour (Asia). Success was in many cases also dependent on the results of experimental plant transfers over long distances, underpinned by a growing belief in the possibilities of acclimatization.

2.2 Acclimatization and Tropicality

In the age of formal empire (the nineteenth and early twentieth century), the tropics represented "an impenetrable barrier to the worldwide expansion of the white races and sapped them of the racial superiority derived from their northern homelands" (Arnold, 2000:13). It was geographers like Ellen Semple[34] and Ellsworth Huntington who most forcefully articulated these themes, deploying, "...a mixture

[34] For more on the reception of Semple's 1911 text, see: Keighren, 2006.

of environmental determinism and Social Darwinism to demonstrate that northern climates bred vigour and intelligence while the tropics were conducive to racial decay" (Arnold, 2000:13). Though Semple was often dismissed as being simplistic, Huntington's 'moral discourse of climate' (Livingstone, 1991) gained widespread approval. In *Civilisation and Climate* (1915), Huntington contended that the tropics would drag even the superior races down to primitive levels. As Arnold (1996c), and others have explained, it should be noted that in this respect, 'the tropics' were generalised considerably, and many places termed tropical when they were really not, as a way of defining something environmentally and culturally distinct from Europe whilst also perceiving a high degree of common identity between the constituent regions of the tropical world. "Tropical nature was... part of the formation of Europe's identity as a place of temperateness, control, hard work and thriftiness as opposed to the humidity, heat, extravagance and superfluity of the torrid zone" (Stepan, 2001:36).

In its newness, the tropical world held out both promise and terror - the promise of tropical wealth and the terror of the unknown. "But the most crucial fact *was* known, Europeans died there with considerably greater frequency than they did in Europe. Whatever else it held out, a visit to the tropics meant running the gauntlet of disease and death" (Curtin, 1964:58). Curtin (1989) provides a comprehensive account of the pattern of disease costs and deaths associated with relocating to the tropics over the course of the century through the analysis of military medical data. Gelfand (1965) and Headrick (1981) also both document numerous doomed early European expeditions to Africa.

In 1777-79 during William Bolts' expedition at Delagoa Bay, 132 out of 152 Europeans on the journey died, and Mungo Park's 1805 adventure to the upper Niger resulted in the deaths of all Europeans present, the nature of tropical disease not yet understood (see section 2.3). "It is interesting that in the equipment he [Mungo Park] requisitioned in 1804 he asked for a mosquito net and two pairs of mosquito trousers for each man, obviously having become well acquainted with this insect, although completely unaware of its connection with the fever" (Gelfand, 1965:10). Instead, climate was seen to be the main problem as David Arnold explains:

> Although 'intemperance', 'venery', and imprudent dress, diet and demeanour among new arrivals might add to their vulnerability to disease, the tropical climate was almost universally considered to be the prime cause of European ill health and to distinguish the diseases of 'warm climates' from those of the temperate zone. The heat, humidity and rapid temperature changes of the tropics were thought to have a grievous effect on European constitutions, to predispose to disease, even where they did not actually cause it, just as the abundant and tiresome insects, the rapid processes of putrefaction and decay, and the offensive smells of swamps and rotting vegetation added to the acute, indeed palpable, sense of tropical danger (Arnold, 1996b:7).

Ethno-climatological arguments came to outline a close relationship between climate, human anatomy and cultural development. Medical historian Nancy Stepan traces these environmentally deterministic notions that hot climates were unfit for human habitation back to Montesquieu's *Spirit of the Laws* (1748). Common associations were made between apes and the supposedly lower black races, and a popular line of thought emerged which assumed that with less brain activity, more disease, and problematic soils, it was hardly surprising that the tropical peoples had failed to build up higher civilizations of their own (see Livingstone, 2002a).

Stepan's *Picturing Tropical Nature* (2001) is part of a group of publications which consider the "way in which tropical nature has been imagined, produced and interpreted in modern history" (2001:13), and reflects on the work of nineteenth and twentieth century scientists and artists to explore the very construction of the 'tropics'. Other important contributions are the special issue of the *Singapore Journal of Tropical Geography* on 'Constructing the Tropics' (2000),[35] Driver and Martin's edited volume (2005), "an exploration of images of the tropical world produced by European travellers over the past three centuries" (2005:3), and Ryan (1997) who explores photographic representations of the British Empire, and the role of the camera and photograph in expeditions, travel, military campaigning, hunting, and the teaching of geography.

The "pathological potency" (Livingstone, 1999:106) of these regions rendered them particularly dangerous for Europeans, relative to the temperate zone, and many questioned whether Europeans would ever be able to survive long-term in the

[35] *Singapore Journal of Tropical Geography.* (2000). **21**(1), including contributions by Driver and Yeoh, Arnold, Duncan, Naylor, Taylor, Stepan and Livingstone.

tropics. Even though "temperate climates were thought to endow their inhabitants with the special ability to rule" (Deacon, 2000:282), there was a great fear that long residence in India (and the 'tropical' regions in general) would lead to the loss of attributes which distinguished the imperial race. Or as Harrison explains, "There was a growing feeling that each race was fitted by nature to a particular environment and that acclimatization could never be more than superficial" (1999:18).

But rather than accept apparent fate, a new science of 'acclimatization' emerged with the aim of discovering if, how, and where Europeans could acclimatize to a full or partial degree, to the exuberant tropical realm. "Today, the term 'acclimatization' is used principally in respiratory physiology and exotic plant and animal management" (Osborne, 2001:136), but it is French in origin, first appearing in the eighteenth century, associated with exotic plants and efforts to breed merino sheep, the words *acclimatation* and *acclimation* entering the English language around 1820 (Anderson, 1992a). The word held an array of meanings and applications over the nineteenth century and was often used interchangeably with 'naturalisation' or 'domestication'. Osborne (2001), Anderson (1992a) and Livingstone (1987) provide the most comprehensive summaries of the unique science.

Discourses of acclimatization came to pervade many aspects of colonial living. A truly interdisciplinary topic, acclimatization was of interest to geographers, physicians, naturalists and amateurs. "Those in power formulated a potent brew of race theory, geographical pathology, and global politics. They called it the study of 'acclimatization' and for much of this period [the nineteenth and twentieth centuries] it was both creditable science and conventional medicine" (Anderson, 1996a:63). Anderson names the nineteenth century as, "a century of acclimatization" (1992a:135), when, as never before, "Europeans mobilised the natural world to their economic and cultural advantage" (1992a:135). Acclimatizers dramatically altered the biogeography of the world, intervening in its natural order.

2.2.1 Human Acclimatization

Although it was widely accepted that the tropical environment was "no place for a white man" (Lawson in Anderson, 1996a:63), the imperatives of imperialism stated that the tropics were just the place for white dominion over man and nature. Before the 1830s[36] Anderson asserts that the popular belief was one of monogenism, that the human race had a single origin and that all men could adapt their specific constitutions to new environments, largely through the adoption of local customs and habits.

> However, such optimism was becoming rarer after mid-century [the steep fall in European mortality in the tropics having leveled out from the 1850s (Curtin, 1989)] as anti-acclimatizationists, drawing increasingly upon evolutionary arguments, stressed the adaption of different races to different environments [each race having its own origin - polygenism]. In these terms, Europeans might only adapt to the tropics through an infusion of native blood, or be able to survive by short posting and frequent returns to temperate climes to allow the body to regain equilibrium and strength (Worboys, 1996:184).

These polygenist beliefs were imbued in publications like James Johnson's hugely influential text *The Influence of Tropical Climates on European Constitutions* (1821) which took the view that, "the tender frame of man is incapable of sustaining that degree of exposure to the whole range of causes and effects incident to, or arising from vicissitudes of climate" (Johnson in Livingstone, 2000a:96).

Race was an enduring category with which to explore disease distribution and susceptibility. In the nineteenth century and in a colonial context, to an extent it did not matter whether the cause of a disease was deemed to be miasma or microbe,[37] theories of racial predisposition to disease prevailed. "But just as Europeans were especially vulnerable to diseases deemed tropical, equatorial races appeared particularly susceptible to any disease to which their ancestors had not become inured" (Anderson, 1996b:100).

For those who did brave the tropics, recuperative visits home were frequently prescribed alongside other preventative measures. Advice from colonial physicians concentrated on diet, exercise, clothing, and personal conduct, combined with the study of medical topography or the identification of less vulnerable zones. By mid

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[36] Osborne (2001) points out that references to human acclimatization (the ability to adjust and thrive in new climates and environments) and seasoning (the process of adjustment) appeared with increasing frequency after 1830 when the French were debating the problems of settling Algeria, and Britain was questioning the future of its Australian and Indian interests.
[37] Developments in medical theory are explored more in section 2.3.

century some experienced individuals were beginning to recognise that morbidity and mortality were not the inevitable results of residence in India.

> Very many individuals go through life in all parts of the empire, with perhaps only a single attack of one or two of the greater complaints – and not a few will pass thirty years in India unscathed...And if sickness should overtake the dwellers in any one of the Presidencies, baffling the skill of the practitioner, great facilities exist for resorting to the sanatory hills in the vicinity of each town (Stocqueller, 1857:129).

2.2.2 Hill Stations

At the beginning of their Indian encounter, the British had been restricted to enclaves along the Indian coast – the sea providing the required relief from the high temperatures. But by the nineteenth century, they were ruling the greater part of the subcontinent and new refuges were needed, colonial duty replacing trade as the expressed interest in India. "The year 1858 is recognised as the watershed for colonial rule in India" (Kenny, 1997:660), as the EIC was dissolved and Queen Victoria was named as sovereign of the Indian Empire. New dilemmas about how to rule emerged following the mutiny.[38] The violence of 1857-1858 led to a politics that emphasised inherent racial differences aided by the environmentally deterministic thinking which was popular at the time.

> In an atmosphere of recent danger, the health and well-being of British civil and military personnel assumed primary importance... The assumption that Europeans would enjoy better health in the hill and plateau country created growing enclaves of civilian and military retirees despite medical statistics that did not necessarily match their reputations (Kenny, 1997:661).

The links between altitude and freedom from disease had not been quickly identified in India. Writing from the Nilgiri Hills during 1847, explorer Sir Richard Burton observed, "...we demi-Orientals, who know by experience the dangers of mountain air in India, only wonder at the man who first planted a roof-tree upon the Neilgherries" (1851:187). Nevertheless, in contrast to earlier thinking where

[38] Under the administration of Governor General Dalhousie (1848-56) the last of the independent Indian states were annexed by the British. Consolidation involved a degree of westernisation being introduced through the development of the road and rail system and the founding of three universities. Following new regulations requiring sepoys to serve overseas thereby losing caste, heightening tension between government and population and the allocation of gun cartridges smeared with the fat of cows and pigs (unclean to both Hindu and Muslim elements), rebellion was inevitable. See Metcalf, 1995.

attempts had been made to shut out the air, early in the nineteenth century, "a few people began to realise that an exposed, windy site might be more healthful than a low-lying, sheltered and quiet one..." (Spencer and Thomas, 1948:640). Mitchell (1972) points to the Greek association of mountain environments and the development of vigorous people. Altitude was key as, "British medical theory of the nineteenth century also judged areas that were free of jungle vegetation and located above the 'fever range', which was defined as 4,500 feet, as environments that would escape the impact of miasmas" (Kenny, 1991:112). Items of apparel like the cholera belt or cummerbund (see Renbourne, 1957) and the solar topi were also introduced at this time (Kenny, 1991).

The fact that these sublime landscapes, 6-8,000 ft in elevation became known as 'hill' stations seems a little strange. In his study of the 'magic mountains', Kennedy (1996) explains the odd choice of terminology as part of an etymological effort to minimise the disturbing implications of the sublime – scaling back the overwhelming force of the landscape so as to render it more suitable for the recovering invalid. Arnold explains how this appreciation of the 'sublime' and 'picturesque', instead of contradicting the image of the perilous tropics, "...served rather to reinforce it, for behind every enticing vista lurked a lethal miasma. The tropics were treacherous as well as dangerous, their beauty a deadly deception" (1996b:10).

The first official role for the hills was as sanitaria for the sick English military. Sanitaria within India held great advantages in terms of savings in sick expenses (Aiken, 1987). "In many cases it no longer became necessary to give leave for the Cape or for Europe, but it was found sufficient to give a short leave for the hills, the soldier or civilian being still within hail" (Clarke, 1881:560). With the end of the mutiny and the assumption of control by the Crown from the EIC in 1857, "the army in India came to constitute the largest single concentration of British troops outside the United Kingdom - one-third of all British forces" (Ramasubban, 1988:38). High rates of morbidity and mortality continued to threaten the security of this force, and in an atmosphere of recent danger, methods of health preservation and restoration assumed high importance across the subcontinent (Kenny, 1997).

Hill stations offered emotional renewal and almost miraculous recoveries from disease (Reed, 1979). Subsequently marketed as the tropical equivalents of the European spas and seaside resorts (see Jennings, 2006), sickly civilians soon followed the military up into the hills, desperate to find an alternative to the long, costly and uncomfortable voyages back to Europe whilst plagued by infirmities. Lord William Bentinck authorised the establishment of Simla in 1819 (Clarke, 1881) and during the summer of 1827 the governor general, Lord Amherst, who was in perfectly good health, chose to spend some time, for recreational and preventative purposes, at the Himalayan sanatorium, acting to popularise the custom of retreating to the hills (Spencer and Thomas, 1948). By 1838 Simla was the recognised government and military summer headquarters for India (Spencer and Thomas, 1948), and quickly became known as the "resort of the rich, the idle and the invalid" (Kennedy, 1996:22).

Gradually more stations were established (figure 2.2) and a definite seasonal movement of people to and from the stations was established. "Over 80 such settlements had been constructed by the British in the higher elevations of India between 1820 and the 1880s. As the hill stations proliferated, retreat to the hills was viewed as a necessary European response to life in South Asia" (Kenny, 1997:655). Along with the opening of the Suez Canal in 1869, the development of the hill stations as summer resorts encouraged more British women to travel to India (Blunt, 1999), overall acting to legitimise British homes in the colonies. However, some stated that women in the hills (away from their men) led to break-ups of homes, threatening not only domestic security but also the legitimacy of imperial rule (Blunt, 1999).

Figure 2.2 – Hill Stations and Summer Resorts of the Orient

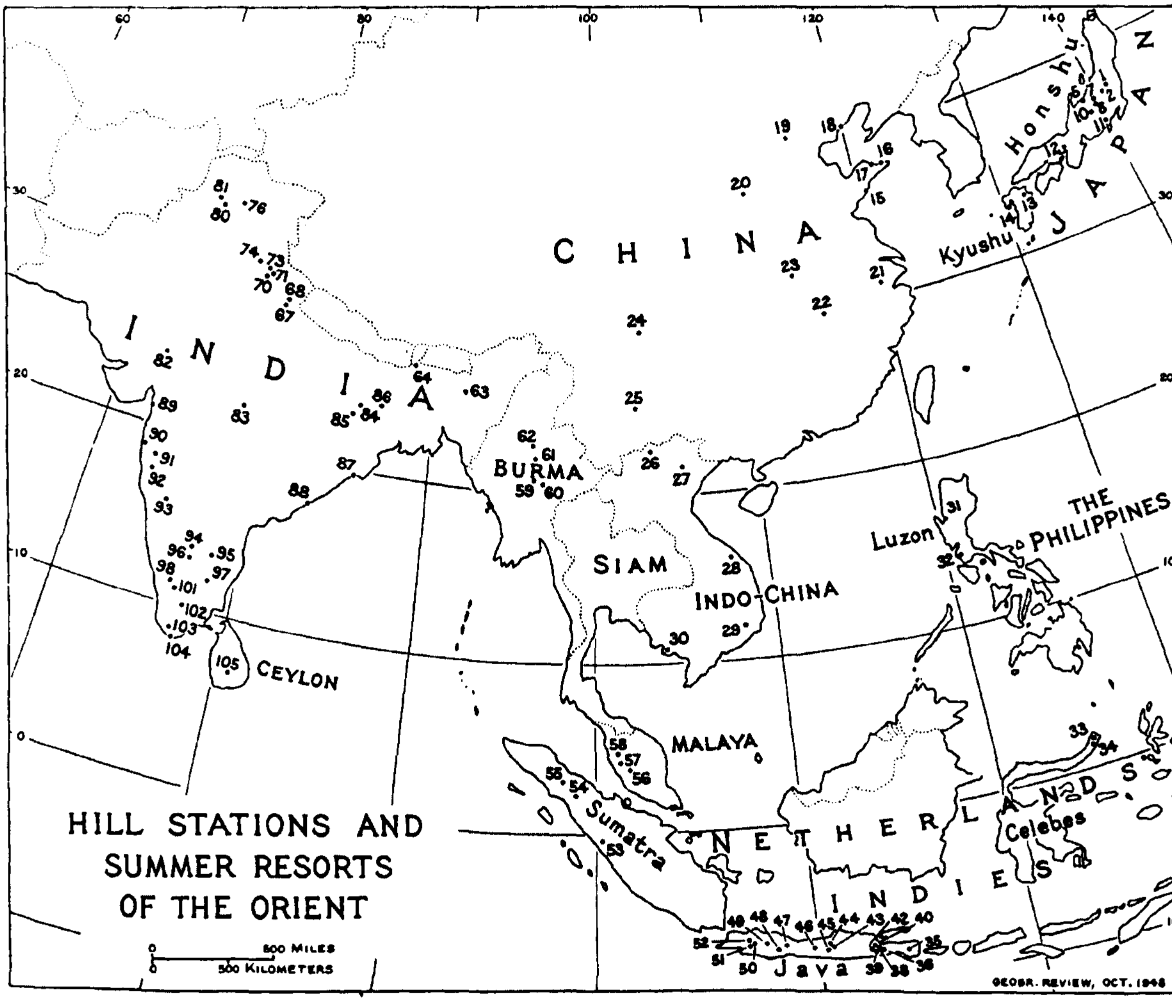

FIG. 1—Key: Primary stations indicated by an asterisk. Inset numbers are situated close to preceding stations and are not separately indicated on the map. Elevations are in feet in round numbers.

Japan	
1. Nasu	3000
*2. Lake Chuzenji	4200
3. Nikko	2000
4. Nikko-Yumoto	5100
5. Akakura	2500
6. Lake Nojiri	2200
7. Kusatsu	4500
*8. Karuizawa	3200
9. Jisogawa	4000
10. Lake Suwa	2500
11. Hakone	2400
12. Rokko San	500
*13. Beppu	Beach
*14. Unzen	2400
China	
15. Tsingtao	Beach
16. Weihaiwei	Beach
17. Chefoo	Beach
*18. Peitaiho	Beach
19. Western Hills, Peiping	1200
20. Yutaho	3000
21. Mokan Shan	2000
*22. Kuling	3500
23. Chikung Shan	2500
24. Omei Shan	4000
*25. Kunming	6200
Indochina	
26. Chapa	4700
27. Tamdao	2500
28. Bana	3000
*29. Dalat	4700
30. Popokvil	3200
Philippines	
*31. Baguio	5000
32. Tagaytay Ridge	2200
Celebes	
33. Rurukara	3000
34. Tondano	2300
Java	
35. Sempol	5500
*36. Tosari	6000
37. Nongkodjadjar	4000
38. Lawang	1635
39. Malang	1460
40. Prigen	2000
41. Tretes	2700
42. Songgariti	
43. Salatiga	1900
44. Oenarang	2200
45. Merbaboe	4000
46. Wonosobo	3400
47. Koeningan	2200
*48. Garoet	2300
49. Bandoeng	2400
*50. Sindangalaja	3500
51. Soekaboemi	2000
52. Buitenzorg	800
Sumatra	
53. Fort de Kock	3000
54. Perapat	3000
55. Bandor Baroe	3000
Malaya	
56. Frazer's Hill	4300
57. Cameron's Highlands	4500
58. Maxwell's Hill	4000
Burma	
59. Kalaw	4200
60. Taunggyi	5000
61. Maymyo	3200
62. Mogok	4000
India	
63. Shillong	4500
*64. Darjeeling	6800
65. Kurseong	4800
66. Kalimpong	4000
67. Naini Tal	6400
68. Almora	5500
69. Ranikhet	5000
70. Dehra Dun	2300
*71. Mussoorie	6800
72. Landour	7400
73. Chakrata	7000
*74. Simla	7100
75. Kasauli	7000
76. Srinagar	5200
77. Gulmarg	8500
78. Sonmarg	8750
79. Paghalgam	7200
80. Murree	7400
81. Abbottabad	4000
82. Mt. Abu	4000
83. Pachmarhi	3500
84. Hazaribagh	2000
85. Ranchi	2100
86. Madhupur	820
87. Puri	Beach
88. Waltair	Beach
89. Dumas	Beach
90. Matheran	2500
91. Poona	1850
92. Mahabaleshwar	4500
93. Ramandrug	3200
94. Nanidrug	4000
95. Madanapalle	2500
96. Bangalore	3000
97. Yercaud	3200
*98. Ootacamund	7500
99. Coonoor	6100
100. Kotagiri	6500
101. Coimbatore	1200
102. Kodaikanal	7000
103. Kuttalam	2500
104. Cape Comorin	Beach
Ceylon	
105. Nuwara Eliya	6200
106. Diyatalawa	4100
107. Bandarawela	4000
108. Hatton	4000

Source: Spencer and Thomas, 1948:643.

The hills allowed the creation of a hybrid social world, and as their populations increased, typically British or Dutch features were added; "Private bungalows, hotels, clubs, racecourses, polo fields, shops, botanical gardens, schools, churches, banks, newspapers, roadway and path systems, and, more recently, tennis courts, golf courses, swimming pools, and other amenities have been added to stations having sufficient space" (Spencer and Thomas, 1948:641). It is easy to see why the hills were often referred to as "India's summer playgrounds" (Kenny, 1991:108), this association with being "places of pleasure" (Clarke, 1881:529), sometimes acting to undermine their serious role. "In these segregated social milieus the colonists could give teas, participate in field sports, exchange gossip, organise musical and dramatic groups, parade new fashions, and engage in other integrative communal activities reminiscent of home" (Reed, 1979:464).

The hill stations also acquired significance in the political geography of empire. As centres of power they acted as sites for both refuge and surveillance. "These were places where the British endeavoured at one and the same time to engage with and to disengage from the dominion they ruled" (Kennedy, 1996:1). Distancing Europeans from the heat and the natives (following the belief that 'native' peoples were already infected with disease and colonial officials not) (Frenkel and Western, 1988), several authors have noted the apparent 'invisibility' of the Indian servants who accompanied Europeans to the hills (Kenny, 1997, Kennedy, 1996). When labourers from the plains were acknowledged, "...the fact that these shivering servants did not do well in the highland climate served simply to reinforce the notion that this was a realm uniquely suited to the racial requirements of the British" (Kennedy, 1996:36). Pradhan (2007) provides an account of the transformation of Simla, Darjeeling, Ootacamund and Mount Abu from summer stations to imperial capitals.

There is no doubt that these remote retreats offered some health benefits when compared to some of the densely populated regions of the subcontinent where disease spread rapidly. However, the growing popularity of the hills soon acted to obliterate the very qualities that were beneficial to health. Aiken's study of Penang, Malaysia, reveals that they were far from free from disease themselves, with poor drainage, dirty and overcrowded conditions, rudimentary medical knowledge, crude and unhygienic hospitals and large scale ignorance of the better medical knowledge and adaptive behaviour of the Asian cultural groups commonplace (Aiken, 1987). As Kennedy (1996) acknowledges, recommendations for recuperation in the hills gradually switched from those suffering from clinical disease to those suffering from overwork or heat exhaustion. As medical significance was granted to the vague illness that affected Europeans in India, scientific justification for holidaying in the hills was thus formulated, hypochondria being part of the psychology of empire.

Some questioned whether the coolness of the tropical hills was the same as temperate coolness (Arnold, 1996c), and the hills were not deemed an appropriate residence for all Europeans as Panter-Downes explains: "Even the early Victorian British in India considered that the sharp air of the hills would probably be fatal to constitutions accustomed to a hot climate" (1967:24). Katie Platt, author of *The Home and Health in India and the Tropical Colonies* (1923), sounded this note of caution regarding children in the hills;

> The innumerable parties, dances and elaborate entertainments for children, which are a striking feature of fashionable hill stations, make the children blasé and dissatisfied with simple pleasures; and they become overtired and excited. Further they are apt to acquire infectious diseases, which are always prevalent in centres occupied by a floating population of children coming from all parts of the country (1923:436).

Still those who failed to reside in the hills risked degeneration and their children becoming 'weedy' and suffering 'hybridisation'.

> The horticultural terminology was purposeful: it alluded to the mutations that any species might experience in an alien environment over the course of several generations. With this thought in mind, medical authorities and others concluded that the prudent course for colonists was to seclude themselves within greenhouses of their own making, supplemented by occasional transplanting back to native soils (Kennedy, 1990:132).

Success in acclimatizing typically English plants to the Indian hills provided further support for their suitability for the European body. In 1881, Clarke (using statistics from the public records of India), emphasised the industrial capabilities and opportunities offered by the hills, the recent successes in cinchona, tea and coffee cultivation acting as effective marketing tools.

Gradually, the hills became 'Indianized' and lost their appeal to the British (Kenny, 1995). In the period prior to independence in 1947, increasing numbers of guidebooks appeared written by and for Indians, which advertised the therapeutic benefits of the hill resorts. The outbreak of the First World War gave a temporary boost to hill station fortunes as many of the British were forced to remain in India, but the end of the war saw a significant population decrease, and reduced shipping costs meant that many Britons returned home.

This research project is situated at South India's most famous hill station – Ootacamund – the development of which is considered in chapter 4. "As one of the earliest of the hill stations, Ootacamund, in the Nilgiris of southern India, provides an appropriate site for study of a colonial development form that became synonymous with health, superiority and escape" (Kenny, 1991:109).

2.2.3 Experimental Plant (and Animal) Transfer

For many, the questions over human acclimatization could not be separated from similar issues raised by agriculturalists and zoologists regarding plant and animal acclimatization. "The introduction of foreign strains of crops and the domestication of exotic animals were subjects that bore directly on the question in hand" (Livingstone, 1987:362).

Linnaeus had been convinced that each pair of animals had been created in, and was therefore suited to a distinct climatic zone. In late eighteenth century France, Buffon, the keeper of the Jardin du Roi also firmly believed that each flora and fauna belonged to a particular geographical region (Anderson, 1992a). When migration did occur, even within the confines of a climatic region, the limited transformation that took place represented degeneration in aesthetic terms at least, for example the camel having apparently diminished to a llama in South America. For Humboldt and his followers, the somewhat mysterious 'tropical zone', offered the strongest resistance to changes in the natural distribution of vegetable forms (Anderson, 1992a).

In 1828, Roulin proposed that animal species could eventually adapt to changed environmental circumstances, and Lamarck (publishing in the early part of the nineteenth century) also believed in the possible transformation of the individuals of a species, and was influential in establishing the notion of the inheritance of acquired characteristics. "In the British sphere, the term [acclimatization] tended to signify a transfer of so-called exotic organisms from one location to another with a similar climate" (Osborne, 2001:137). Gentlemen breeders embraced the new science and concentrated their efforts on "seeking out unchanging ornamental plants for the garden and animals for the hunt" (Anderson, 1992a:137), there being at that time little government support for practical zoology or botany. By the 1830s, French natural scientists were discussing deliberate and systematic acclimatization (Anderson, 1992a), and the terms were soon being used with frequency in the most advanced scientific circles through much of Europe.

Experiments in plant acclimatization had begun much earlier. When Mahe de Labourdonnais arrived as governor of Mauritius in 1735 he immediately embarked on introducing and breeding new crops on his estate at Pamplemousses.

> Labourdonnais had particular success with one crop - manioc, which had been introduced from Brazil, and it proved a useful staple food for the slave population. The success of this innovation, and more especially the idea of cultivating new crops in a specialised garden on a trial basis, meant that his initiative... provided part of the inspiration for the introduction of the botanical-garden system in India (Grove, 1995:175).

Grove speculates that Labourdonnais and his successor Poivre may themselves have drawn inspiration from the acclimatization garden at the Cape run by the Dutch East India Company. On a 1770 visit to the Cape, Poivre had declared that, "...nothing is more agreeable than to see in different expositions even in the same enclosure, the chestnut, the apple and other trees which are natives of the torrid zone" (in Grove, 1995:196).

Robert Kyd, soon to become founder and honorary Superintendent of the Calcutta botanic garden, became interested in the idea of transferring spice trees from the Himalayan ranges on the eastern frontier to Calcutta in 1776. He went on to develop the idea of deliberately cultivating and bringing drought-resistant crops together in one place, with the intention of distributing them to peasants living in drought-prone regions (Grove, 1995:333). The EIC surgeon William Roxburgh (later Kyd's replacement at the Calcutta garden) arrived in Madras in 1776 where, during his first few years he spent time supervising the construction of an acclimatization and botanical garden at Samulcottah, north of Madras. According to George King (a later Superintendent of the Calcutta gardens), Roxburgh introduced coffee, cinnamon, nutmeg, arnotto and sappan wood as well as the breadfruit tree, the mulberry tree and various kinds of pepper vines as well as conducting experiments with sugar cane. He also advocated company sponsorship of food-tree planting to secure supplies of coconut, sago, date and Palmyra palms as well as from plantain, jackfruit, breadfruit and opuntia trees (Grove, 1995), in an attempt to protect the region from famine.[39] In the 1780s, the EIC authorities became increasingly aware of "the advantages that might be gained from playing an active role in promoting and investing in crop experimentation and from efforts to transfer new crops and centralise them in botanical gardens in company territories" (Grove, 1995:336), elevating the status of botanical science and botanists. Increasingly it was thought more appropriate to carry out botanical experiments not in England but in the colonies.

However, in the 1830s, the EIC lost interest in the gardens, and it was largely the efforts of William Hooker (1785-1865) which enabled the botanical gardens in India to survive. Although there were significant barriers to success, by the 1850s it seemed that degeneration in the quality and form of plants subject to long distance transfer was not inevitable. As Schama explains, "The difference between the attempts of the Renaissance botanists to encompass the world in a garden and the imperial tropical gardening of the nineteenth century was simply the industrial marriage of glass planes and iron ribs... When forced hot-water heating was added, whole forests of exotic vegetation could luxuriate beneath the glass" (1995:564).

2.2.4 Societies and Institutions

In France, once natural science was rendered relevant to the nation's economy, Geoffroy St-Hilaire had begun searching methodologically for potentially profitable plants and animals founding both the *Jardin d'acclimatation* (1859) and the *Société d'acclimatation* (1854) (Anderson, 1992a). The society promoted the introduction of productive agricultural species into France, and the garden (opened to the public in

[39] For more on the history of plant transfers at the Calcutta Botanic Garden, see Thomas, 2006 and Hastings, 1986.

1860) served as a showcase of the treasures of the colonies, giving acclimatization a "cultural presence not seen in other capitals" (Osborne, 2001:144). As Anderson explains, "As well as providing nurseries for new seeds, it allowed for the breeding of stags, alpacas, llamas, yaks, reindeer, giraffes,[40] kangaroos, ostriches, elephants, camels, and hippopotamuses" (1992a:144), many of which were consumed at the Society's regular dinners! The French went on to introduce tropical plants and animals to Algeria thus improving the 'inferior' domestic species. Indeed Auguste Hardy, director of the *Jardin d'essai* at Algiers declared in 1860 that, "the whole of colonisation is a vast deed of acclimatization" (in Osborne, 2001:136). Osborne's work places France and its empire at the "epicentre" of the acclimatization movement (Beinart and Middleton, 2004:12).

Anderson explains that in the British context, in time, "A loose alliance was forged between the scientists who were interested in the distribution and external conditions of plants and animals and the horticulturalists and livestock breeders who had, over the years, acquired first hand experience with variation, inheritance, generation, and selection" (1992a:147). Thus acclimatization activity had been occurring on the periphery of the British Empire for some time before a specific society was formed in 1860 (the same year as cinchona arrived on the Nilgiris), by the eccentric journalist Frank Buckland (figure 2.3).

The society was typically more in tune with the interests of the gentleman breeders and enthusiasts rather than those of the naturalists, placing emphasis on the introduction of game birds and fish. The society lacked gardens, so its efforts in introductions could only take place in Kew, or Regent's Park, or on the estates of its enthusiastic members (such as the breeding of eland[41] on Lord Derby's estate). "The Acclimatization Society searched the world for a suitable animal of moderate size – not poultry, nor small pork, nor white meat – which an average English middle class family might eat with pleasure" (Anderson, 1992a:149). It concluded that eland were the answer (see Lever, 1992). Society activities were informally chronicled in *The Field* magazine but even after amalgamation with the ornithological society it could only claim 270 members in the mid 1860s, and "most

[40] For a story of giraffe acclimatization see Allin (1998), the tale of a Masai giraffe captured in the Sudan in 1826 and shipped to the French King Charles X as a gift from the Viceroy of Egypt.
[41] The eland is the world's largest antelope.

of its acclimatizable animals had by then been digested" (Anderson, 1992a:148). The society was disbanded in 1866 (Osborne, 2001).

Figure 2.3 – Founder Patrons and Council of the Acclimatisation Society of the United Kingdom. Listed in the First Annual Report, 1861.

3

SOCIETY FOR THE ACCLIMATISATION

OF

Animals, Birds, Fishes, Insects, and Vegetables

WITHIN THE UNITED KINGDOM.

PATRONS.

The Duke of Newcastle
The Duke of Rutland
The Duke of Sutherland
The Marquis of Breadalbane
The Marquis of Conyngham
The Marquis of Clanricarde
The Earl of Albemarle
The Earl of Tankerville
The Earl of Malmesbury
The Earl of Craven
The Earl of Pomfret
The Viscount Bury
The Viscount Uffington
The Viscount Somerton
Lord Tredegar
The Viscount Powerscourt
The Earl Spencer
Viscount Hill
Viscount Newport
Viscount Southampton
The Earl of Mountcharles
The Earl of Lichfield
Miss Burdett Coutts
Sir Roderick I. Murchison, Museum of Economic Geology, Jermyn-street
The Hon. Grantley F. Berkeley, Winkton House, Ringwood, Hants
Sir George Wombwell, Newburgh Park, Easingwold, Yorkshire
Professor Owen, British Museum
Sir Culling Eardley Eardley, Bidwell Park, Hatfield, Herts
Hugh Childers, Esq., 57, Eaton-square
J. Gould, Esq., Zoological Society
Andrew Drummond, Esq., Cadland, Southampton
— Chamberlayne, Esq., Southampton
T. Pilkington Dawson, Esq., Groton House, Suffolk
William Knapp, Esq., The Hill, Walnerley
Henry Townsend, Esq., Castle Townsend, Ireland
Thomas Blackwell, Esq., Montreal, Canada
Professor Quekett, Royal Coll. of Surgeons
Mr. Chief Justice Temple, 46, Elgin-crescent, Notting-hill
President of the Royal College of Surgeons
Col. Howard Vyse, Old Windsor
Dr. Günther, British Museum

COUNCIL.

The Marquis of Breadalbane
The Viscount Powerscourt
The Hon. Grantley F. Berkeley
Higford Burr, Esq., Aldermaston, Reading
J. Crockford, Esq., 346, Strand. W.C.
B. Waterhouse Hawkins, Esq., Belvedere-road, Upper Norwood. S.
James Lowe, Esq., 15, Duke-street, Adelphi
J. H. Walsh, Esq., 22, Kensington-square. S.W.
W. B. Tegetmeier, Esq., Apiarian Society, Muswell Hill
L. MacKinnon, Esq., Bittersea House, Mill Hill, Hendon
Capt. S. Dawson Damer, M.P., 2, Chapel-street, Grosvenor-square
E. W. Nix, Esq., 77, Lombard-street
C. S. Townshend, Esq., Fellow of Jesus College, Cambridge

President—THE MARQUIS OF BREADALBANE.

Vice-President—THE HON. GRANTLEY F. BERKELEY.

Bankers—Messrs. COUTTS & CO., Strand.

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Treasurer—J. BUSH, Esq.

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Source: Lever, 1992: plates. Original BL. Mic.f.232 [no. 22920].

The phenomenon was widespread; "Acclimatization societies flourished in most of the major European cities during the second half of the nineteenth century, in Berlin, London, Amsterdam, Brussels and Moscow" (Anderson, 1992a:146). Some of the more successful societies were founded in the temperate settler colonies, such as the Acclimatization Society of Victoria (1861) which "vigorously acclimatised hundreds of European animals and plants, many so successfully that their predators were later introduced merely to control their numbers" (Anderson, 1992a:147). Dunlap notes the enthusiasm of New Zealanders, "People in all the cities, many large towns, and even the country took part, and eventually the network of 'acclimatization districts' (established by the Protection of Animals Act in 1873) covered the entire country" (1997:306).

More widely Dunlap explores the potency of plants and animals in the colonisation of Australia, Canada, New Zealand, and the United States, describing how,

> "...they [the colonisers] made a familiar domestic landscape, planting European grasses, flowers, shrubs, and trees in their dooryards and along the streets and roads. They also... tried to reshape the landscape for pleasure and sport by stocking it with birds and animals that recalled 'home' or could be hunted" (1997:304).[42]

Collectively, these societies, "promoted colonisation and functioned as a vast network for the exchange of ideas, techniques and organisms" (Osborne, 2001:136). A dichotomy of purpose existed in which Europeans attempted to make the tropics more European and simultaneously create a more exotic and tropical Europe.

As time passed, ideas of appropriate conduct changed and, "the idea of bringing Egyptian geese and alpacas to Europe had become outdated and disturbingly vulgar" (Anderson, 1992a:153). Repeated failures contributed to the folding of many societies. By the 1890s, there was also an awareness of the evils of acclimatization, several introduced species having become pests in their new homelands, the sparrow in America, the mongoose in Hawaii and Puerto Rico and the rabbit in Australia. As one reviewer noted in *Nature*, "The English Acclimatization Society fortunately came to an end, before it had time to do any harm here [in England]...its example had been mischievous in our dependencies" (in Osborne,

[42] This was also common practice at Ootacamund, see chapter 4.

2001:141). However, Rolls (1984) concluded that the Australian acclimatization societies should not bear the blame for initiating the transfers and importation of deer, fox, rabbit or prickly pear which later came to be seen as agricultural pests.

Acclimatization has had its revivals. Increasing population in the 1920s directed attention once more to the sparsely populated tropics both as potential sources of food and a possible future home for surplus white peoples (see Trewartha, 1926). For the most part though, "Acclimatization is intimately entwined with the rise of modern imperialism and with the marginalisation and alteration of indigenous ecosystems and peoples" (Osborne, 2001:135), and confined to the second half of the twentieth century. Successes served as symbols of Europe's superiority and power over far off lands, and failures illustrated the limits of European science.

2.3 Tropical Medicine

The tropics played a crucial role in the microbiological revolution in medicine (Stepan, 2001). Traditional European medical treatments such as bleeding, purging and excessive use of mercury had little positive effect on the health of patients suffering from tropical diseases in India and so during the seventeenth century Indian physicians were regularly employed by the EIC (Parrotta, 2001).

As David Arnold explains, "It was, and perhaps largely remains, the conventional wisdom that tropical medicine only emerged as a medical speciality in the final decade or so of the nineteenth century" (1996b:1), and particularly with the work of Patrick Manson in the 1890s, culminating with the publication of *Tropical Diseases: A Manual of the Disease of Warm Climates* in 1898 and the founding of the London School of Tropical Medicine in 1899. However, as Arnold points out, the second half of the title of Manson's book, "...in effect invoked the medicine of an earlier age" (1996b:3), explaining that,

> ...Medicine was a conspicuous element in the process of European exploration and colonization virtually from the outset – in the search for medicinal herbs and spices, in the struggle to stay alive in new lands, in the manner in which the newcomers exchanged or extracted knowledge, healing goods and therapeutic services in places as far apart as Mexico, India, Java and Japan (1996b:5).

It is the immediate 'pre-Mansonian' age of western medicine which this thesis explores. Although the distinctive nature of tropical disease and medicine had become apparent from the mid-eighteenth century as a result of the increased involvement of European traders, soldiers and sailors in 'the tropics', (the trans-Atlantic slave trade and plantation industries in the Caribbean being major stimuli (Arnold, 1996b:8)), it was the 1850s when people increasingly concluded that the main obstacle to civilization in the tropics were tropical diseases (particularly fevers), rather than direct exposure to inhospitable climates (Arnold, 2000), although the two remained linked and climate continued to attract a level of scepticism even into the twentieth century. A new awareness of the special features of tropical disease and the early speculations of germ theory positively reinforced the perceived risks to Europeans living and working in areas classed as tropical (Stepan, 2001). As will be seen in chapter 4, the growing application of statistics to illustrate patterns of disease (and recovery), the growth of medical geography and topographical studies, and aesthetic taste, all "...further established the distinctiveness of tropical climates and diseases" (Arnold, 1996b:9). James Lind's *Essay on Diseases Incidental to Europeans in Hot Climates*, first published in 1768 had a wide and enduring reputation (Arnold, 1996b:12). The tropics presented new challenges to physicians and, "tropical medicine was also intellectually exciting. Successful researchers had to be open to experimentation, ingenious at problem solving, and innovative in difficult climates – the 'stuff' of missionary medicine" (Lyons, 1988:244). European medicine was often brought to the colonies by missionaries, and in a discussion of the Cook Islands, Lange (1988), names rhubarb, peppermint, chaulmoogra and opium based analgesics among the drugs missionaries ordered from London.[43]

There is an increasing awareness that European medicine can no longer be considered an "accident of empire" (Macleod and Lewis, 1988:*x*). With its essential purpose being the survival of the white races and the social control of native populations, it has proved to be an imperialising cultural force. For Headrick (1981) and Mukherjee (1998), western medicine proved crucial to the success of European expansion and domination over large parts of the world. Plant drugs like cinchona became vital strategic resources with important demographic and political effects

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[43] For more on 'mission gardens' see Bravo, 2005.

(Brockway, 1979a, 1979b). Indeed, writing in 1879, the Superintendent of the Government Central Museum of Madras wrote to Kew's Assistant Director: "To England, with her numerous and extensive possessions, it is simply priceless; and it is not too much to say, that if portions of her tropical empire are upheld by the bayonet, the arm that wields the weapon would be nerveless but for cinchona bark and its active principles" (in Brockway, 1979a:103).

The recipients of tropical medicine emphasised its necessity, as it was upon them that the empire relied for stability.

> For European doctors in the nineteenth century, tropical medicine and military medicine were nearly synonymous. That connection is one reason why the progress of tropical medicine and the conquest of tropical empire have sometimes been linked – much as imperial conquest of tropical empire has been linked to the flood of new weapons from an industrializing Europe (Curtin, 1996:99).

However, Worboys suggests that in actual fact, "...doctors practised (ordinary) medicine in the tropics, not a distinctive kind of (tropical) medicine" (1996:183). Still, the statistics show that army doctors stationed in the tropics made enormous progress in keeping European soldiers alive between the 1840s and the 1860s. In Madras the death rate fell from an average of 41.5 per thousand between 1837-46, to 19.86 per thousand between 1859 and 1867 (Curtin, 1996:100). But it was not simply a case of tropical medicine clearing the way for imperialism, as Curtin explains, "The new public health measures helped, but the genuine improvement was equalled and sometimes outweighed by misunderstanding and downright misrepresentation" (1996:106), noting the high, yet largely unreported and invisible death rates experienced in the Magdala (1868) and Asante (1874) campaigns.[44] Health policy in colonial India also remained primarily aimed at safeguarding the interests of a small minority of the European population in India, western medicine thus having very little influence over the Indian population as a whole (Ramasubban, 1998).[45]

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[44] These two "campaigns to exercise the troops" in Africa were important in forming European opinion about the disease cost of small wars for empire. Both were hailed at the time as brilliant military achievements under great leadership (Curtin, 1998:29).

[45] The target population for the receipt of quinine manufactured from Nilgiri bark is discussed in section 2.3.4 and in chapter 6.

However, there is widespread acceptance of the positive impact of sanitary reform measures on both mortality and morbidity. "In the last quarter of the nineteenth century doctors and sanitary officials were increasingly confident about the potential of sanitary measures and the relatively minor role played by climate as such" (Worboys, 1996:185). This development came with the arrival of 'germ theory', and a better understanding of the causes of disease. But the picture remained clouded because, as Worboys (1996) explains, there was not a single 'germ theory'. "Rather there were several and competing theories about the nature, spread and action of germs" (Worboys, 1996:182).

Although confusion over disease causation remained, this did not stop the search for effective treatments, many of which were derived from plants.

2.3.1 Medicinal Plants

The tropics (in the broadest sense) were home to many of the plants which were found to act as treatments for tropical diseases (although in many cases disease and cure remained separated by thousands of miles). "The impact of plant-derived medicine on human history has been remarkable; opium, snakeroot, digitalis, feverbark, and chaulmoogra have all left their leaf prints on the human time line" (Sumner, 2000:15). It is believed that the 'secondary' medicinal compounds of plants arose to protect them from predators, and, "from earliest times mankind has used plants in an attempt to cure diseases and relieve physical suffering" (Hill, 1952:242). But as Merson explains, "While many of these materials were traded throughout the ancient world, it was not until the development of European colonial empires that moving plants from one side of the globe to another took on real economic significance" (2000:285).

Following the opening of direct sea routes between Europe and India at the end of the fifteenth century, an era of expanded trade in spices and medicinal plants was opened in the early sixteenth century by the Portuguese with the establishment of trading bases in Goa and Cochin (Parrotta, 2001). The English EIC, chartered in 1600, established its first trading post in India in 1612, and, "between 1588 and 1669, the proportion of drugs imported to England from outside Europe (mostly from India and Southeast Asia) grew from 14 to 70%" (Patterson, 1987 in Parrotta, 2001:9).

A "rhubarb mania" (Foust, 1992:*xvi*) was experienced in the eighteenth century. A key role was played by the English and other EICs, with huge quantities of medicinal (also termed Chinese) rhubarb offloaded in London (the chief centre of the trade) by the 1760s. Strong connections between botany and medicine had already led to the development of physic gardens. "The first physic garden in England began at Oxford in 1621 on five meadow acres near Magdalen College to cultivate diverse samples for the advancement of the faculty of medicine" (Sumner, 2000:55). Chelsea is the most historically significant physic garden, founded in 1673.[46]

Schiebinger draws attention to the additional value *medicinal* plants brought to empire when she states that, "European naturalists also contributed to Europe's expansion by providing new medicines to keep European troops and planters alive in the colonies" (2005:120). Of course some indigenous people were keen to guard the secrets of their medicines and to protect their plants, environments and industries, and so "along with miraculous cures came the silence of secrets" (Schiebinger, 2005:129).

Throughout history the cultivation and export of medicinal plants has raised ethical questions, the majority centring around the problem of ownership; To whom do cures (in terms of both the plants and the knowledge of their medicinal properties) 'belong' — the people in the country where the plant grows, or those who discovered the plant's new use? Should the development of plant drugs be motivated by profit or philanthropy? As Merson explains, "In the colonial context, biological resources had been regarded as being part of the global commons and were not subject to property rights, except where specific plant breeding occurred" (2000:284). Many states tried to prevent the export of medicinal plants (including cinchona bark from South America) but, "the dominance of European powers, and the disregard for intellectual property rights other than those possessed by European industry, made such efforts fruitless" (Merson, 2000:287). In the case of cinchona and many others, European scientific enterprise, capital and political

[46] For more on Chelsea and its founder Hans Sloane (1660–1753) see Atkins, R. Will, E, and Yates, K. (n.d.). *Celebrating Sloane*. London: Chelsea Physic Garden.

power drove a native industry off the market in favour of a vast plantation based industry completely controlled by Europeans.

New scientific advances in the nineteenth century led to the extraction and identification of the active pharmacological agents from many of the better-known plants, which in turn led to major advances in medical treatment, and an increased demand for many medicinal plants.[47] Dosage was critical, as in most cases, given in too large a dose the medicinal powers of plants usually acted as dangerous poisons.

Although, as Sumner documents, "with the advent of synthetic chemistry...much of the past century has seen a decreased reliance on botanicals[48] as sources of original therapeutic compounds, particularly in the western world" (2000:9), there is a growing recognition that Mother Nature may possess solutions to at least some of our present day medical problems, the study and search for medicinal plants remaining both important and controversial today. "Medicinal botany is still a vastly unknown field. Systematic botanists estimate that there are at least 250,000 species of flowering plants and that fewer than five percent have been investigated for their medicinal potential, despite years of human interaction with plants as our primary source of effective medicines" (Sumner, 2000:37).

The focus also remains on the tropical world, where an exploitative system continues to support the western world at the expense of the flora rich nations.

> At least seven thousand of the most commonly used drugs in Western medicine are derived from plants. Much of this comes from the biologically rich environments of the tropics, and is worth US $32 billion a year in sales worldwide. However, while Third World countries supply and maintain the bulk of these resources, they receive only US $551 million in return (Merson, 2000:285).

There has also been an acceleration of interest in the potential of alternative or complimentary medicines as many begin to lose faith in synthetic drugs. 'Ethnobotany' (the study of plant uses by indigenous peoples) is a growing field. There is a very large trade in plants used for the preparation of phyto or herbal

[47] Morphine was isolated from opium in 1803, and was followed by other isolations including quinine (1820), atropine (1831), and cocaine (1860).
[48] For example neither aspirin nor salicylic acid is now made from natural willow bark (see Taylor, 1965:200), and synthetic versions of quinine have largely replaced the use of cinchona bark in medicine.

medicines, used by homeopaths and herbalists and which can be purchased in health food shops, supermarkets and pharmacies (Lewington, 1993). As a case in point, the former cinchona plantation at Dodabetta (see below) has now been converted into a Medicinal Plant Development Area (MPDA). "After taking over by Forest Department the abandoned Geranium, Rosemary, Thyme, Citronella, Gaultheria and other herbal crops were restored and re-established and they were brought back into production" (Tamil Nadu Forest Department website).[49]

2.3.2 Malaria History

> It is next to impossible to exaggerate the curse that malaria has been for countless centuries. It has killed more people than all the wars, more than all the plagues, even the Black Death. And for the millions it does not kill it leaves a legacy of fever, chills, weakness and such a lack of ambition that the poor and destitute victims are usually left to swelter in their own stench (Taylor, 1965:74).

Poser and Bruyn (1999) is the most comprehensive review of the disease, accompanied by an impressive and wide-ranging selection of images, from portraits to advertising ephemera. As Gelfand explains: "Malaria is one of the most ancient diseases known to mankind. Descriptions given by the Romans and Greeks show they were well aware of it... even then the fever was linked in some way with marshes..." (1965:2). Some suggest it is perhaps older than man (Harrison, 1978). As Worboys identifies, "Any discussion of malaria in the nineteenth century has to begin with the differentiation of malaria as a generic term for miasmas and miasmatic diseases and its subsequent restriction to a specific, febrile disease" (1996:186), this differentiation occurring in the mid-nineteenth century.

Malaria had been widespread in Britain in the seventeenth century (see Dobson, 1998), but by the nineteenth century was regarded as a 'tropical' disease, to be feared intensely by Europeans. The cause of malaria remained a mystery until 1897 and the discovery of its mosquito transmission by Ronald Ross (of the Indian Medical Service).[50] An age old association of malaria with swamps had previously

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[49] http://www.forests.tn.nic.in/ProjectPrograms/About_medicinal_plants.html [Accessed 16/01/10]. Also see http://www.indiaenvironmentportal.org.in/node/2098 [Accessed 16/01/10] and section 3.4.

[50] "Ross showed that the malaria germ went through several further developmental stages in the mosquito and was transmitted actively by inoculation both ways: from human-to-mosquito in blood, and from mosquito-to-

blamed humid air and putrid smells for the disease hence the name *mal'aria*, or bad air.[51] "Sanitarians and others supposed that a malarious poison or ferment, developing from decaying matter in the soil, was spread by evaporation after rain, or arose from soil disturbed by agricultural or urban development" (Worboys, 1996:187). Others advocated the 'chill theory' (where febrile syndromes produced by the effects of heat acted on the constitution). The two theories could also work in combination, disease being produced by an external agent but predisposition being determined by sudden spells of cold. Worboys notes that the influence of both theories can be seen in the three main ways of avoiding or combating the disease: "1) to find or create settlements in areas free from the poison or from extremes of temperature;[52] 2) to take individual precautions to mitigate exposure to the same variables; and 3) to use quinine as a preventative and a cure, this acting either as an antidote to the poison or a febrifuge" (Worboys, 1996:188). All three strategies are explored in this thesis.

Conquering malaria was viewed as a necessary development for European settlement in the tropics, and more particularly in Africa, known as 'the white man's grave' (see Jennings, 2006).

> Over the years scholarly opinion has suggested that European subjugation of Africa was preceded by another conquest, the conquest over malaria, the main killer of Europeans. It was after the European death rate dropped, especially as a result of the successful introduction of quinine as a prophylactic, it has been argued, that colonial conquest became a feasible or at least attractive option for the European powers (Cohen, 1983:23).

As Macleod and Lewis explain, "Unlike most of the diseases endemic in East Africa, malaria and sleeping sickness impinged directly on metropolitan interests, and so became the main focus for colonial medical activity" (1988:8). As Michael Gelfand said in 1965, "When I think of disease in Africa, malaria always comes to mind... The European living in Central Africa to-day must find it hard to believe that the opening up of Africa and the whole future of white settlement on this continent once revolved around the fever" (1965:1). However, Cohen's exploration of the relationship between quinine, malaria and French imperialism, reveals that in a

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human in the saliva of the biting insect. This made the mosquito an intermediate host as well as a vector..." (Worboys, 1996:193).

[51] Jarcho (1970) provides a comprehensive cartographic and literary study of the word 'malaria'.

[52] Ootacamund was one such settlement, see chapter 4.

context where quinine was not used as a prophylactic systematically until after World War II, rather than the conquering of malaria paving the way for imperialism, it was successful French empire building which eventually lowered the loss of French lives overseas.

> From early on the French recognized that they could lower the number of their casualties by employing indigenous soldiers and porters for their military expeditions...Also the possession of empire 'seasoned' the European troops; once surviving the first exposure to malaria, their death rates were lower than fresh troops never before exposed... The conquest of a colony ensured that greater amenities [mules, medical and food supplies, improved housing etc] would be available for the Europeans... Once the initial conquest was completed and permanent forts and residencies built, an environment was established which was less attractive to mosquitoes (Cohen, 1983:31-35).

Nevertheless, as "... malaria ceased to be a 'disease in the tropics' and became the paradigmatic Mansonian 'tropical disease'" (Worboys, 1996:183), it became a major obsession for European science, which came to focus on the natural qualities of the bark of the cinchona tree as the solution. Jaramillo-Arango (1950), and Harrison (1978) both recall the historical struggle against the disease, and the progress achieved.

2.3.3 Cinchona and Quinine

Before the discovery of cinchona and quinine, all manner of remedies were suggested for malaria:

> The most typical remedy... was spiders used both as a therapeutic and a preventative...In the west of England spiders were imprisoned in a box, and as they withered away so it was believed the ague lessened. It was thought they absorbed the miasmata or contagious air as a sponge soaks up water...In India their webs were employed, and even as late as 1867 we find that the *Indian Medical Gazette* highly praises cobwebs as a cure for fever (Gelfand, 1965:4).

Other 'popular' treatments proved to be much more damaging.

> The classical method of treating malaria was taught in the 1810s and 1820s at the Val-de-Grâce, the army medical school, by the influential Dr J. Broussais. While he allowed for a light dose of quinine as a treatment (too light to have an effect), he mainly advocated

> bleeding, the application of leeches to the patient,[53] and a starvation diet. The result of such draconian treatment was that patients already anaemic from malaria would become further anaemic and in fact also starved to death (Cohen, 1983:28).

It is thus not surprising that "cinchona bark and its derived quinine alkaloids were the most effective treatment for malaria from the 17th century to the 1940s" (RBGK Economic Botany website).[54] Alongside the derivatives of the foxglove (digitalis) and the opium poppy (morphine), cinchona and its derivative quinine, have long been recognized as medicinal 'superstars.'[55]

There are a variety of fantastic tales regarding first usage of cinchona bark, one of the most popular being that a Peruvian Indian, overcome with fever, was forced to drink stagnant water from a pond into which several cinchona trees had fallen. "Enough alkaloids had been extracted by the prolonged maceration that, within hours of drinking the solution, the [Peruvian] Indian's fever had abated and he eventually recovered" (Tyler *et al.*, 1988:206). Early South American usage is entirely dependent on whether malaria was present before the arrival of the Spanish. Bruce-Chwatt (1965) advocated that "It is probable, but not proved, that malaria existed in the Americas before the Spanish conquest and there is some likelihood that seagoing peoples brought it to the New World long before Columbus' voyages" (in Poser and Bruyn, 1999:8). However Gramiccia, believing that Indians in Peru were not aware of the specific power of the bark explains, "They used the Cinchona tree for timber and fuel, and believed that the Europeans wanted it for its value as a dye. The Indians started using it against fevers long after the Europeans, and at first, according to Mutis (1805) they had to be forced, tied up and submitted to severe punishment, to take the drug that would save their life" (1987a:5). Greenwood sums up the recent consensus that, "...malaria was most probably not present in South America before the Spanish invasion, so the native population could not have known of its specific value in the periodic fevers of malaria, although they may have used the bark for other purposes" (2004:1).[56]

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[53] Leeches were used to treat a wide variety of ailments at this time.
[54] http://www.kew.org/collections/ecbot/collections/topic/cinchona/index.html [Accessed 16/01/10].
[55] http://www.uihealthcare.com/depts/medmuseum/galleryexhibits/naturespharmacy/introduction.html [Accessed 16/01/10].
[56] For an overview of the debate see Poser and Bruyn, 1999:8-9.

The genus was named by Linnaeus in honour of the Countess of Chinchon, the wife of the Viceroy of Peru who was apparently cured of her fever (or ague) after taking an infusion of the bark in 1630, her doctor having learned of the bark's use among Indians from Jesuit missionaries (who had arrived in the country just after 1560 (Gelfand, 1965:4)). The legend of the Countess, which Haggis finally proved false in 1941, is described by Gramiccia as a "remarkable public-relation tool for the founders of the Spanish Empire" (1987a:5).

There is less doubt surrounding the contribution of Jesuit missionaries, particularly in the Loxa (also Loja) area (now Ecuador), in the bark's introduction to Europe (Gramiccia, 1987a), with the Jesuit Cardinal Juan de Lugo usually credited with spreading the fame of the 'Jesuit's bark' (Greenwood, 2004:1). As Lee explains, "It is difficult to be certain about the persons (and dates) as the Jesuits had all the attributes of a secret society: they communicated with each other in a secret code and also were prepared to use their knowledge of the bark to aid their struggles for power within the Church!" (2002:189). Jarcho (1993) traces the bark's reception in the medical community culminating in the important publications of the Modena physician, Francesco Torti (1658-1741), who constructed a taxonomy of fevers and made recommendations for cinchona's use.

By 1650 regular shipments of the tree's bark were reaching Spain (Kew Economic Botany website),[57] but the Protestant north of Europe quickly came to regard the 'Jesuit's' or 'Cardinal's' bark as a Popish remedy, treating it with grave suspicion or outright condemnation.[58] Confusion also arose between the cinchona bark and the Peruvian balsam tree (*Myroxylon peruiferum*) known as quinaquina, especially "...as this was not in short supply many dishonest merchants substituted it for or added it to the cinchona bark, thus ruining the reputation of the true quinine bark with the medical profession" (Gelfand, 1965:5). In 1658 it was announced in London that the bark could be obtained from several London chemists (Gelfand, 1965:5). The observations of Sydenham (1666), and Torti (1712), on the specific action of the bark on malaria, and their recommendation for larger and more protracted doses, rendered the need for accurate information about the tree even more urgent. It was

[57] http://www.kew.org/collections/ecbot/collections/topic/cinchona/index.html [Accessed 16/01/10].
[58] Oliver Cromwell's death has been attributed by some to the fact that he flatly refused the remedy on these grounds.

Robert Talbor, who recognized the importance of administering the correct dose of the drug[59] (in larger quantities it could act as a poison), and popularized the drug in England, particularly in marshy and malarious Essex, making a fortune in the process and becoming physician to the King (see Dobson, 1998 and Gelfand, 1965:5-6).

The Spanish Crown declared a monopoly on all imports in 1751, and as well as trading in the bark, the King apparently gave away large quantities to hospitals throughout Spain (Kew Economic Botany website).[60] "By the eighteenth century sugar was the largest cash crop imported into Europe from the Americas, but Peruvian bark (quinine) was the most valuable commodity by weight shipped out of America into Europe" (Schiebinger, 2005:119). Still, as Dobson documents, the quality of the bark remained a major and complicated concern. "Fever barks of inferior and superior qualities and from different South American plants continued to swamp the malaria markets of Europe...for much of the eighteenth and nineteenth centuries (Dobson, 1998:75).[61]

After the quinine alkaloid was isolated in 1820 by the French scientists Pelletier and Caventou (figure 2.4), demand for the drug increased dramatically. Fears regarding the impending extinction of the tree in its natural habitat emerged, prompting efforts in its cultivation. It should be noted that the bark was still not universally accepted, with James Johnson (1821) leading the crusade against the bark. However, mid century Edward Hare (following James Lind's recommendations for a full dose as soon as fever was recognised), treated 7,000 patients with quinine alkaloid over a period of 9 years, and recorded a mortality rate of less than one percent. "This was most impressive and the main hospital in Calcutta then gave the drug a trial for a year. During this period their mortality figures for malaria was reduced ten times. The remedy was established at last" (Gelfand, 1965:7).

It was the naval officer Alexander Bryson who recognized and popularized the prophylactic use of quinine, and it was the application of his advice that led to the

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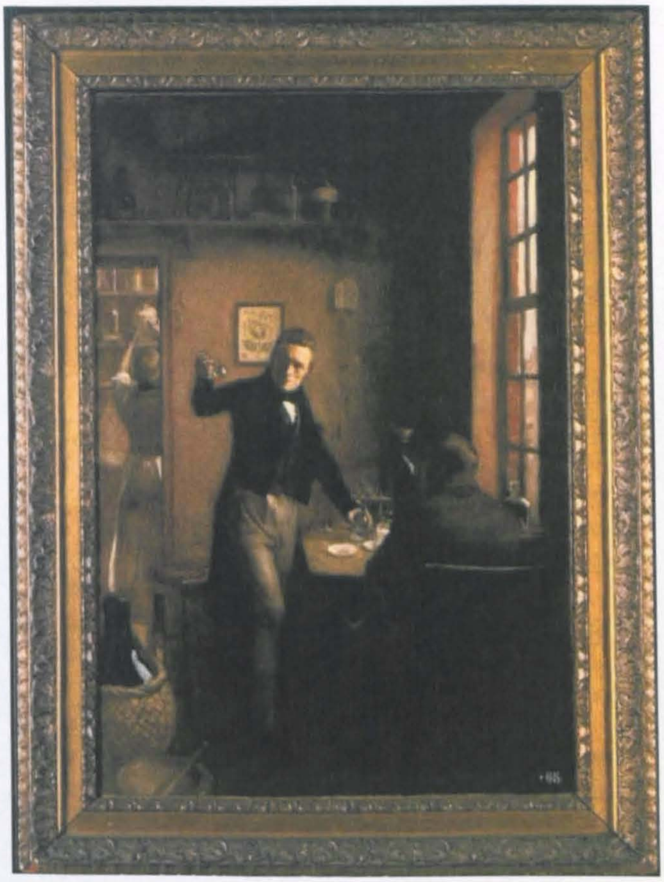
[59] Usually infused in red wine at this time.

[60] http://www.kew.org/collections/ecbot/collections/topic/cinchona/index.html [Accessed 16/01/10].

[61] For more on this early history of Cinchona see Lee (2002), Honigsbaum and Willcox (2004), and section II of Jaramillo-Arango's classic *The Conquest of Malaria* (1950).

success of the 1854 Niger expedition under Dr. William Baikie, and Dr. Livingstone's on the Zambesi, which impelled him to write to the Foreign Office to declare Central Africa well suited for European occupation (Gelfand, 1965:34-35). Gelfand also documents the development of artificial alternatives to quinine and the application of insecticides to mosquito eradication including the now tarnished/ill-fated DDT[62] campaign.

Figure 2.4 – 'The Discovery of Quinine, 1820' by Ernest Board,[63] (191-)



Source: Wellcome Images.

2.3.4 The Cinchona Story

The history of writing about the cinchona tree has been an important consideration in writing this thesis. Quinine was the Holy Grail for economic botany in the

[62] Dichloro Diphenyl Trichloroethane, an insectide widely and effectively used to kill mosquitoes during the second half of World War II. It was banned in 1972, owing to its detrimental environmental impacts, but the mosquito had already started to develop some resistance against it.
[63] Ernest Board (1877-1934) was born in Worcester and educated in Bristol. He exhibited in the Royal Academy from 1902. He painted a number of scientific and medical 'firsts', including; 'Christopher Wren making his first demonstration of a method of introducing drugs into a vein', 'Joseph Priestley, the discoverer of oxygen', 'Dr Jenner performing his first vaccination, 1796', and 'The discovery of the barometer: Torricelli experimenting in the Alps, 1643'. 'The discovery of quinine, 1820' depicts the French chemists Pelletier and Caventou and is currently on display at the Biblioteca Nacional de España, Madrid.

nineteenth century (Drayton, 2000), and from the outset of this research undertaking there has been an awareness that versions of this story had been told before. As Kavita Philip contends, "There are many ways this story could be told. As historians, we make narrative choices based on our theoretical and methodological commitments" (2003:172). The story owes its appeal to the fact that it is at one and the same time a scientific thriller, adventure novel, and fascinating biography of several notable individuals who devoted their lives to cinchona or as Lucile Brockway put it, "The cinchona transfer is one of the most intrigue-filled tales in plant history..." (1983:34).

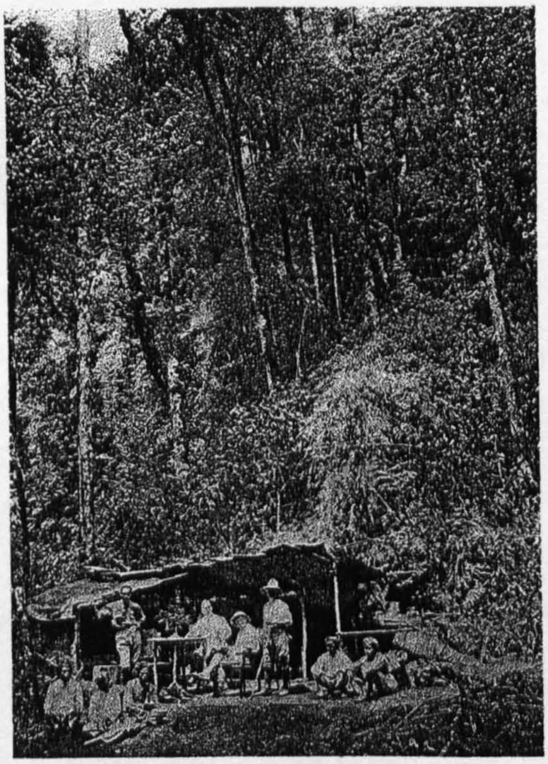
Brockway's 1979 account of the experiment remains the most famous, but the bitter bark's story has also been tackled by several other authors in explorations of the role and utility of botanical gardens and their networks (see Hepper, 1982, Drayton, 2000, Hyams and MacQuitty, 1969), in compilations of 'plants that changed the world' (Taylor, 1965, Hobhouse, 1999 and Musgrave and Musgrave, 2000) and in two recent popular histories of cinchona (Honigsbaum, 2002 and Rocco, 2004), alongside a growing quantity of academic scholarship, delivering the story to a wider audience. Rocco provides an account of quinine's role in making the modern world, organised by world region, successfully giving a global perspective on the development of the drug through history. Honigsbaum's study is based very much on the courage and determination of three key figures (Charles Ledger, Richard Spruce and Clements Markham) in the endeavour, with much of the book set in South America, Honigsbaum following in the plant hunter's footsteps. He brings the study up to date by including a chapter on contemporary vaccine hunters, speculating as to the likely impacts of global warming and growing drug resistance on malaria.

The first group of publications addressing the cinchona experiment appeared during the 1940s, at a time of renewed military importance on malaria control and quinine therapy during World War II (see Haggis, 1941, Taylor, 1945, Duran-Reynals, 1947, and Jaramillo-Arango, 1949). Taylor's[64] intention in *Cinchona in Java: The Story of Quinine* (1945) was to highlight the long process of exploration and experiment, loss and vexation through which the quinine industry had passed,

[64] In 1945, Taylor was the Director of the Cinchona Products Institute in New York.

acknowledging quinine's contribution to the Second World War. His geographical focus is Java, by then the location of the world monopoly (figure 2.5). In dismissing the British efforts in the bark's cultivation, he documents the reasons for the Dutch success. Honig *et al.*, (1945) is another comprehensive account of the Javanese plantations, with chapters of the story written by successive early Superintendents.

Figure 2.5 – Prospecting for new Cinchona sites in the Preanger Regency of western Java



Source: Taylor, 1945:11.

A second group of academic papers are more recent, perhaps inspired by studies of other commodities (see above), a new interest in botany, disease and empire and the ongoing fight against malaria and infectious disease. They began with Brockway's 1979 accounts which revealed that the link between quinine and imperialism was stronger than most.

> Quinine was also essential to the British, French, and Germans in their 'scramble for Africa', where appalling death rates had confined Europeans to the coast until quinine prophylaxis was adopted. It seems no coincidence that the New Imperialism of the late nineteenth century represented a European expansion into parts of the world where malaria was hyper-endemic (Brockway, 1983:35).

With Indian production of quinine "enabling the British officer and his Indian soldiers to resist malaria and stay in fighting trim... without the ravages of periodic bouts of fever, and enabling the British sahib to bring his wife and children to live in India" (Brockway, 1979a:126), Brockway specifically explored the competition, co-operation and power politics between the European powers that was characteristic of the time - English and Dutch competition being an important attribute of the cinchona industry. Highlighting the importance of luck in the Dutch cultivation, in the way high yielding *Cinchona ledgeriana* seeds[65] found their way to Java, Brockway explains how this, combined with the "Dutch programme of intensive care of the cinchona trees gave them a further advantage over the British planters, and by the 1890s a cartel of Dutch quinine processors had control of the market" (Brockway, 1983:34).

Goss (2004, 2009) has recently added to scholarship in the Dutch context. In positioning the 'quinine engineers' or professional government botanists as what he terms 'floracrats', he examines the development and maintenance of scientific authority and the reconceptualisation of botany as civil science (capable of developing colonial society), and its strong links to colonial government. "In the 1860s and 1870s, these quinine engineers effectively positioned themselves and their Cinchona knowledge as the perfect instrument of liberal colonial policy. As officials, their mission was to make Cinchona cultivation viable. By placing themselves between bureaucrats and planters, they built the first institution in the Indies to maintain scientific authority permanently" (Goss, 2004:79).

McCracken (1997) also focused on the competition with the Dutch empire in referring to the British cinchona scheme as having been disastrously hijacked. Grammiccia (1987a, 1987b) chose to focus on Charles Ledger's exploits in the cinchona project. In a 'critique of British cinchona policy' from 1998, Mukherkjee concluded that "the British Cinchona cultivation in India on the whole ended in failure... Indian production of quinine sulphate was not sufficient to meet internal demand" (1998:93). In focusing on the plantations in the Bengal Presidency and the efforts and successes of Dr. Thomas Anderson, Superintendent of the Royal Botanic

[65] For more on this particular story see Grammicia, 1987b.

Garden, Calcutta, Mukherjee concludes that, "the introduction of quinine as therapeutic measure disregarded not only traditional Indian disease perceptions... but early studies of Indian medicinal plants done by the European scientists in India as well" (1998:83). Drayton similarly named the scheme "...an agronomic failure in any commercial sense..." (2000:231) demonstrating how the 'failure', was transformed into 'public relations gold', when claims were distributed that there had never been any profit motivation in mind.

Lee provides more reasons for his negative judgment of the project from 2002. "Many of the trees succumbed to attack by insects, and the yield of quinine from the bark of the varieties established in India could not compete with *Cinchona ledgeriana* which had been introduced successfully into Java" (2002:194). Similarly Etemad, in arguing against Headrick's notion of quinine as a 'tool of empire', explained, "Although government plantations in British India had been started at the same time as those in Java, they never managed to equal them. Indian Cinchona production – which, incidentally, supplied bark of highly variable quality – never even met the needs of the colony" (2007:30). Endersby wrote of the cinchona experiment, "One of Kew's supposed successes was cinchona...Yet this much vaunted transplantation was a failure – the varieties the British acquired and planted in India proved to have a low quinine content, while the Dutch trees in Java proved much more productive" (2008:234).

Muraleedharan (2000) considered quinine and malaria policy in India between 1900 and 1930 when the ideal of achieving self-sufficiency and having an efficient form of treatment and distribution within the reach of the masses in India remained a distant dream. Barton (2007) studies the same period, and in particularly the 'quinine fraud', revealing the widespread adulteration of official supplies of quinine practiced in Indian hospitals which damaged the reputation of the drug and increased the suspicion of western medicine more generally.

Commentators have managed to find some chapters of success, by placing the experiment within a bigger story, or by being selective over which of the original narrative frameworks the story is judged. Brockway is the most outspoken in this regard, explaining that "...in guarding the health of the military and the bureaucracy, the main purpose of the cinchona transfer had been accomplished: the

British Raj was strengthened and India secured to the empire" (1979b:458). She later emphasized:

> Those who contend that the British cinchona coup turned out to be a costly fiasco miss the point. The British government did not undertake the cinchona transfer for the benefit of planters, but because it wanted to protect the health of its troops and civil administrators in India, where British rule had been severely shaken by the Sepoy Mutiny of 1857. And this was accomplished: British-made quinine and quinidine were reserved for the representatives of the British *raj*, and Britain's grip on India was made more secure by an influx of soldiers and civil servants who no longer feared 'the deadly climate' (Brockway, 1983:35).

Brockway also believed that there had been positives for the environment suggesting, "...that the environmentalist notions that rhetorically undergirded the cinchona project resulted in labour relations and land-use policies that were less devastating to local communities and soils than the unchecked capitalism of the other south Indian plantation strategies" (1979b:458 and also see Philip, 2003).

Several accounts have noted broader achievements for the venture including the development of botanical and agricultural science and the institutions in which they were housed (most notably the RBGK). According to Drayton the British experiment "established the reputations of individuals and institutions... and would be the model for many other later interventions into colonial agriculture" (2000:211). The rubber transfer is the most notable to have followed the cinchona 'model' (see Brockway, 1979a). The symbolic efficiency or capital of British cinchona is likewise acknowledged by Philip (2003).

> As a grand scheme for the more efficient nurturing of crop plants through the application of modern scientific methods, in the service of the state and of humanity, it created symbolic capital that was successfully invested in the creation of networks of scientists, institutions, and administrators that linked British imperial colonies through botanical gardens and scientific departments in the metropole and peripheries" (2003:181).

Kavita Philip's work on cinchona (1995, 1999 and 2003) chooses to look specifically at Clements Markham's published accounts of the project, exploring his narratives for their ideological, political, economic and scientific significance. Exploration of the cinchona experiment reveals interplay between science, nature, medicine, economics and geopolitics.

2.4 Conclusion

Although this attempt to contextualize the cinchona experiment has revealed a significant body of literature on the history of cinchona, there is still an obvious need for more research on the cinchona plantations themselves. This thesis attempts to fill some of the gaps in the literature, offering for the first time a sustained engagement with the plantations (under both government and private ownership) on the Nilgiri Hills of Southern India, from which the wider experiment emerged. There has not previously been any research completed at the more local and even micro-geographical scale: on the individual plantation or laboratory unit for example, and the role of private plantations in the region in the wider experiment has to date been ignored. The management of Indian cinchona has also so far been absent from research papers, an absence this thesis directly addresses through its analysis of the management of labour and the tropical environment.

3 The Cinchona Archive

3.1 Introduction

Information was essential to all of the great European empires, and gathered intelligence about the world was collated in the archive. "Archives (and archivists as civil servants) emerged as part of the state control of knowledge in early modern Europe, during the later eighteenth century particularly, and in relation to nineteenth-century imperial administration" (Withers, 2002:304). As Stoler explains: "The imperial archive was both the supreme technology of the late nineteenth-century imperial state and the telling prototype of a postmodern one, predicated on global domination of information, and the circuits through which facticities move" (2002:89).

During the nineteenth century, and the study period especially, huge quantities of information in a variety of forms was collated, classified and filed in the archival repositories of the state:

> At no time, perhaps, was the obsession with amassing and arranging global data more feverishly nursed than at the height of Victorian Britain's overseas imperial adventure. From institutions like the Royal Geographical Society, the Royal Asiatic Society, the Royal Society, and most particularly the British Museum, the acquisitive tentacles of empire snaked their way around the globe. Yet the fact-fascination that characterized such spaces ultimately reduced universal geography to the cabinet-sized exhibit and file-sized archive...In one way or another, the data-hungry museum did much to fulfill the surveillance needs of colonial management (Livingstone, 2003:32).

In Derrida's *Archive Fever* (1996), the archive is both a place and a reflection of social and institutional authority and power. As Withers' engagement with the geographical archive reveals, this power may not be expressed straightforwardly, often being the result of the "haphazard accumulation of stuff rather than of pre-ordained governmental scrutiny" (Withers, 2002:305). Thomas supports this idea, explaining that,

> In fact most official Victorian archivists were amateurs…and they improvised a great number of unconventional methods to produce conventional knowledge for the domestic archive…Examined closely, the grand narrative of the nineteenth-century archive fragments into smaller narratives of interdepartmental disputation and finally into autonomous practices – such as the image of the British Museum 'basement', a peripheral zone of lost or forgotten knowledge buried deep within the catacombs of the London archive (Thomas in Richards, 1993:16).

This chapter identifies some methodological issues associated with working in and with imperial archives, before exploring the archive of the British cinchona experiment and its own geography through recounting the history and the functions of the RBGK, and the RGS, and their associated archives. The main groups of sources utilized in this thesis are then noted in turn, alongside a consideration of their associated implications, positives and drawbacks. Personal experience of visiting the sites of the experiment is then discussed, before a conclusion.

3.2 Working in an Archive

3.2.1 Methodological Issues

Archival research forms the basis of this investigation into the British cinchona experiment. The sources available for consultation are extensive both in number and type (see below), and are thus reflective of the detailed recording of the experiment's unfolding. In the majority of the archival repositories where research has been undertaken, a reliance on computerized catalogues and search facilities meant that a greater amount of relevant material came to light than would have otherwise have been selected for consultation, although the variable spellings of key search terms had the potential to obscure and complicate the search (i.e. cinchona/chinchona, Nilgiri/Neilgherry).

Materials relating to the cinchona experiment are scattered through various archives. The cinchona transfer operating in much the same way as Ballantyne explains in his story of his encounter with 'Mr. Peal's archive',

> The conversations and exchanges recorded in the Peal papers were carried out through a restless and seemingly ceaseless shuttling of paper – letters, postcards, telegrams, the purchase and lending of books and periodicals, and the exchange of field notes, word lists, sketches, and off-prints – between individuals and institutions scattered across the empire and frequently occupying very different subject positions (in terms of wealth, political power, intellectual standing, and cultural capital)... (2005:96).

This research is reliant on English language sources, which are predominantly held in national institutions, owing to the status of the experiment as an imperial project. As Ghosh explains, "...national narratives and identities remain strong features in the production of histories particularly in the ways that histories are fashioned from the spaces and conventions of national archives and libraries" (2005:28). In her analysis of the Dutch administration in the Indies, Stoler develops this association between the archive and state power further:

> If it is obvious that colonial archives are products of state machines, it is less obvious that they are, in their own right, technologies that bolstered the production of those states themselves...Colonial statecraft was built on the foundations of statistics and surveys but also out of the administrative apparatus which produced that information. Multiple circuits of communication – shipping lines, courier services and telegraphs – were funded by state coffers and systems of taxation that kept them flush. Colonial publishing houses made sure that documents were selectively disseminated, duplicated or destroyed. Colonial office buildings were constructed to make sure they were properly catalogued and stored. And not unlike the broader racialised regime in which archives were produced, the majority of 'mixed-blood', 'Indo' youths, barred from rising in the civil service ranks, were the scribes who made the system run (2002:90-91).

However Burton reminds us that, "of course, archives – that is, traces of the past collected either intentionally or haphazardly as 'evidence' – are by no means limited to official spaces or state repositories" (2005b:3), and several smaller, non-state archival repositories have also been utilized in this research. Also, personal papers within the national archive were often added after the imperial project was over, and are thus not part of the official record *per se*. However, as succeeding in the cinchona experiment was regarded to be of the utmost importance to the British Empire, material produced during its undertaking was (certainly in the main), deemed to be worthy of transportation to London, ending its journey at national archives. Inevitably the 'official' record of the experiment, written through reports to government, is selective in its content and focus, but remains a tremendously valuable source.

The subaltern or Indian 'voice' is underrepresented in this 'official' record (history favouring those traditionally deemed to be legitimate subjects), but is however not absent from this story, a story in which they inevitably played a significant part (most importantly as the labour force on the cinchona plantations), their actions (whether supportive or disruptive) determined from brief appearances in the British documents. The diverse nature of this subaltern voice is also acknowledged. Gagen *et al.*, further explains this 'precarious' and partial nature of the archive, "Either through the (un)availability of sources, the negotiation of absent, powerful or powerless voices in the archive, or the immaterial qualities of certain kinds of historical source" (2007b:4). Absences then can be just as informative as the presences, as this quote from Perry elaborates;

> ...Archives are not only about what they contain within their walls. They are also about absence, although the absences in the colonial archive are not neutral, voluntary, or strictly literal...silences borne of and perpetuated by violence and radical inequality. But these sorts of silences can speak very loudly, even when empires, courts, and states have least wanted them to (Perry in Ballantyne, 2005:34-5).

Recent attention on archives in historical geographical research has been focused on the personal experience of archival encounter. As Burton outlines:

> *Archive Stories* is motivated... by our conviction that history is not merely a project of fact-retrieval... but also a set of complex processes of selection, interpretation, and even creative intervention – processes set in motion by, among other things, one's personal encounter with the archive, the history of the archive itself, and the pressure of the contemporary moment on one's reading of what is to be found there (2005:7-8).

Practising the archive: Reflections on Method and Practice in Historical Geography, was inspired by similar ideas and is comprised of a group of essays which each offer, "a variety of critical observations about diverse forms of archival encounter, and of how changing conceptual approaches to the practical conducting of historical geography can alter the researcher's relationship with source materials" (Gagen *et al.*, 2007:1). Personal experiences of archival research also depend on the character of the individual institution where research is being conducted.

3.2.2 The Geography of the Archive

Archive Stories follows the recent move in the Western academy to recognize that all archives are 'figured'. "That is, they all have dynamic relationships, not just to the past and the present, but to the fate of regimes, the physical environment, the serendipity of bureaucrats, and the care and neglect of archivists as well" (Burton, 2005:6). Hamilton *et al.*'s edited volume focused on the South African national archive also emerges from this acknowledgment. "In our project, Foucault's influence was strongest in the proposition…that archives are often both documents of exclusion and monuments to particular configurations of power" (Hamilton *et al.*, 2002:9).

Putting these recent engagements aside, "…some of the most democratic of archives still arrive at our sightlines as if they were shrink-wrapped, that is, with very little trace of how they were compiled, massaged, and otherwise packaged for mass consumption" (Burton, 2005:5-6). Burton continues, "Postcolonial studies and theory have provided another important fillip to the notion that archives are not just sources or repositories as such, but constitute full-fledged historical actors as well. This is in part because of the ways in which the colonial archives served as technologies of imperial power, conquest, and hegemony" (2005:7). Although a wide range of archives have been used in this examination of the cinchona experiment, two institutions and their associated libraries and archives stand out as having a specific importance in the experiment – those located at the RBGK and the RGS.

Using the words of Randolph Starn, Ballantyne explains that "…we [historians] tend to use archives without thinking much about them as institutions" (2005:96), adding that, "Historians in general have been slow to scrutinize their archives, reluctant to explore the institutional history of archives, hesitant to examine the cultural and political work carried out by these institutions, and, most tellingly, loath to chart their individual experience of archives" (2005:96-97). Withers (2002) also notes that we should not lose sight of differences in and between archives, and of how such differences may affect our 'styles of reasoning'. Below I offer an engagement with at least the first of Ballantyne's points, in exploring the institutional history of the RBGK and RGS as they intersect with the British cinchona experiment. As Mbembe clearly asserts,

> The term 'archives' first refers to a building, a symbol of a public institution, which is one of the organs of a constituted state. However, by 'archives' is also understood a collection of documents – normally written documents – kept in this building...The status and the power of the archive derive from this entanglement of building and documents (2002:19).

The Royal Botanic Gardens, Kew

The RBGK views its library and archives as, "One of the most important botanical reference sources in the world", containing, "...more than half a million items, including books, botanical illustrations, photographs, letters and manuscripts, periodicals, biographies and maps... acquired by gift, purchase and exchange" (Kew website).[66] Before 1852 there was no formal library at Kew, although from 1846 the Treasury had allowed an annual grant of £10 towards the purchase of books for students and before that time Sir Joseph Banks (the first unofficial Director), William T. Aiton (the second), and Sir William Hooker (the first official Director), had made their own libraries available for consultation. In 1852 the Reverend William A. Bromfield bequeathed his herbarium and library of around 600 volumes, in 1854 George Bentham presented his library of 1,200 texts and, following William Hooker's death in 1865, his library and correspondence were purchased for £1,000. The *Kew Bulletin* began in 1887, and from then a full range of scientific journals was brought to Kew (Kew website).[67]

The main subject of library material is plant taxonomy and systematics, but there is also a wealth of information on garden and horticultural history, as well as travel literature relating to botanical expeditions. A separate library (the Jodrell) holds material on economic botany and medicinal plants. The illustrations section houses an outstanding collection of botanical illustrations dating from the eighteenth century to the present. Archives holds the official records of the RBGK and the papers of many botanists, gardeners and other individuals. The special section Kewensia ('things about Kew') holds material on the history and development of the RBGK.

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[66] http://www.kew.org/library/ [Accessed 16/01/10].
[67] http://www.kew.org/library/about.html#history [Accessed 16/01/10].

As it shall become apparent throughout this thesis, it was not just paper, text-based material which was exchanged around the globe during the cinchona experiment, and this is also reflected in the collections at Kew. The study of plants used by people, known as 'economic botany' had formed an important part of the work of the RBGK since the time of George III, but the collection of artifacts of economic botany became a key focus for the authorities at Kew after Sir William Hooker opened the Museum of Economic Botany in 1848. Hooker had previously been Professor of Botany at Glasgow Botanic Garden and when appointed at Kew had brought with him the collection of textiles, gums, dyes and timber he'd used to illustrate his lectures (Griggs *et al.*, 1998). "In 1846 the architect Decimus Burton converted the old Royal fruit store into a museum building (later named Museum No. 2), opened to the public in 1848" (Kew website).[68] Objects came from Hooker's own collection, from his global contacts and from the displays of international exhibitions like the Great Exhibition of 1851 (Griggs *et al.*, 1998). A purpose built research store opened in 1990, designed to replace the museums. Whilst the majority of objects were acquired during the nineteenth and early twentieth centuries, the collection continues to grow and now comprises around 83,000 specimens, over 450 of which are currently displayed in the Plants and People exhibition in the renovated Museum No 1.[69]

In 1983 the Pharmaceutical Society of Great Britain donated over 10,000 historic specimens of material medica, including crude drugs, herbarium sheets, slides and an extensive collection of cinchona barks, to the RBGK. In 2002, six boxes of mainly manuscript material (found in an archive cupboard at the Royal Pharmaceutical Society) relating to the Quinologist John Eliot Howard (1807-1883) were deposited at Kew, and in September 2006 were catalogued for the first time (RBGK, n.d.).

So, from the mid-1780s as Livingstone neatly summarises, "Thousands of seeds, plants, and dried specimens, some covertly pillaged for commercial gain, others as mere instances of exotic curiosity, found their way to the ecumenical data bank at Kew...Regulating the botanical traffic that flowed back and forth between metropolitan core and colonial periphery, Kew enriched the fiscal and scientific

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[68] http://www.kew.org/collections/ecbot/history/index.html [Accessed 16/01/10].
[69] The exhibition catalogue is Griggs *et al.*, 1998.

capital of the empire" (Livingstone, 2003:55). The website of the RBGK itself declares, "In many respects the history of Kew is a microcosm of the history of the British Empire. Many of Kew's activities were carried out with reference to the central administration of empire, and integrated study of Kew's archives and specimens offers many insights into the motivations and processes involved – often more complex than usually assumed."[70]

The importance of Kew in this exploration of the cinchona transfer relates not only to the amount of paper and plant based material of relevance held in the library and archives today (see below), but is also due to the garden's own role in the transfer, in cultivating plants and preparing them for their journey to India, and in providing gardeners and expertise to direct the experiment. As Ballantyne explains, being in the archive, especially one as fascinating the RBGK can be a rewarding part of research. "The physical space of archives – in their organizational structure, architecture, decoration, signage, and other forms of cultural encoding – provide crucial cues to the kinds of stories that institutions and archivists imagine residing in their collections or want to be produced from their repositories" (2005:100). Walking through the herbarium on the way to the library, or visiting the living cinchona in the temperate house, brings the project alive.

Royal Geographical Society

Founded in 1830, the RGS is, like the RBGK, another institution which could be described both as a product of the Empire and one that also facilitated the Empire's expansion. As Richards explains, "Pre-eminent among the knowledge-producing institutions of Empire, the British Museum was charged with the collection of classified knowledge, both ordered knowledge and, increasingly, secret knowledge, but a variety of other institutions like the Royal Geographical Society, the Royal Society, and the Royal Asiatic Society also formed part of what was widely imagined as an imperial archive" (1993:15). As Driver (2001:29) documents in his history of the RGS, one of the key tasks the Society set for itself was, "The establishment of a centralized archive of authoritative geographical information,

[70] http://www.kew.org/collections/ecbot/research/ [Accessed 16/01/10].

available to legitimate explorers and others to whom such knowledge would be useful (most notably, departments of government)."

The RGS library functions then as an imperial geographical archive, a site akin to the laboratory of natural scientists (Osborne in Withers, 2002), an example of a Latourian 'centre of calculation' or perhaps better put as a centre of interpretation and knowledge making.

Ryan's exploration of the Society's photographic archive demonstrates its critical part in promoting the cause of empire. "Through the influence of prominent Fellows such as Roderick Murchison, the RGS married its promotion of overseas exploration and survey to the needs and ambitions of an imperial nation" (1995:53). With overseas exploration at its heart, the RGS can be strongly linked with the British cinchona expedition, especially as Sir Clements Robert Markham, self-appointed expedition leader, was a fellow of the RGS (1853-1916), one of the Society's Honorary Secretaries (1863-1888) and later its President (1893-1905).[71] William McIvor, Superintendent of cinchona plantations in the Madras Presidency was also a member.

The RGS-IBG secured funds to 'unlock' its archives in 2001 (Withers, 2002), a project which involved making its unique sources for researching nineteenth century imperial exploration more easily accessible, particularly to schools.[72] The holdings include a collection of private journals, notebooks, letters and the addresses of Markham and several family members (approximately 100 items), including some material related directly to the cinchona experiment (see below).

3.3 Sources

This study benefits from a rich body of archival material, both published, and unpublished, text and image based sources which document the exchange of cinchona knowledge and artifacts which took place predominantly between Britain and India (although a wider network of exchange is also starkly apparent) during the Victorian period. This material is held in a variety of archival repositories,

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[71] For more on Markham and the RGS, see Williams, 1962 and 1968, and Savours, 2001.
[72] See the project website: http://www.unlockingthearchives.rgs.org/ [Accessed 16/01/10].

ranging from national public institutions like the BL and RBGK, to more local collections (full details of which can be found in appendix D). A number of items are replicated through the different repositories, but sometimes, as Withers explains, "...knowledge gained in the archive stems often from a unique document" (2002:305).

As Mbembe explains, "We often forget that not all documents are destined to be archives. In any given cultural system, only some documents fulfill the criteria of 'archivability'. Except for private documents (church documents, documents from private institutions, families, companies...), the majority of documents deemed archivable are related to the general work of the state" (2002:19). A great number of documents relating to the cinchona transfer have thus been deemed worthy of preserving and keeping in a public space, though of course it is impossible to estimate how many have been discarded, or lay undiscovered.

As Mayhew notes, traditionally geographers have been insensitive to the material constraints (geographic and historical) in the production and consumption of texts. A recent shift towards emphasizing 'print cultures' looks at the "ways in which different times and spaces have distinct systems of authorship and book production...The aim is to treat books not just as 'data sources', but as themselves historically-embedded products whose modes of authoring, production, dissemination and reception are vital resources of insight to the historical geographer" (Mayhew, 2007:25). Gagen *et al.*, echo this call to direct more attention towards, "...the historically contingent processes through which different forms of writing are indeed made and deployed" (2007:5).

Key characters emerge from the cinchona story,[73] and have themselves been used as a focus for research in the archive. This follows recent interest in using biography to re-think the disciplinary history of geography, and in the creation of new historical geographical scholarship. As Daniels and Nash explain, "Professional geography, a discipline still predicated for some authors on the assumption that the world they describe is more interesting than they are, has taken a reflexive, autobiographical turn. The arts of geography and biography appear closely

[73] Biographies of which can be found in appendix B.

connected; life histories are also, to coin a phrase, life geographies" (2004:450). In their edited volume on *Practising the Archive*, Gagen *et al.*, refer back to the tradition of biography in geography:

> There is admittedly a long tradition of biographic scholarship within geography and while such work had been traditionally criticized on methodological grounds, recent geographical interventions, most notably among geographers interested in the historical geography of scientific practice, have attempted to recast the epistemic underpinnings of past lives. As David Livingstone has recently argued, 'according greater sensitivity to the space of a life could open new and revealing ways of taking the measure of a life' (2007:6).

In the remainder of this section the major sources of information are outlined in turn by source type (beginning with unpublished archive material, and ending with published nineteenth century texts), their benefits and drawbacks discussed, and where appropriate their previous utilization in studies of this type considered. Each source poses its own set of validation issues. Claims to 'truth' need to be addressed, and the authorship and purpose of the production of the item (whether text, image or map) must be uncovered alongside the intended audience, and the associated implications of these answers. There is no doubt that claims of British success were, at times, sensationalised, often to promote belief and pride in the abilities and activities of empire. Yet these 'problems' or uncertainties can themselves provide valuable information – why were certain descriptions of conditions and events selected over others for inclusion in publications? And what impact did they have on the events which unfolded? The standardisation and controlled nature of the experiments and observations which were undertaken is also questionable. This research, like much other historical scholarship is thus a piecing together exercise as Mbeme asserts:

> Through archived documents, we are presented with pieces of time to be assembled, fragments of life to be placed in order, one after the other, in an attempt to formulate a story that acquires its coherence through the ability to craft links between the beginning and the end. A montage of fragments thus creates an illusion of totality and continuity (2002:21).

3.3.1 Written Sources

Unpublished Material

i) Personal Correspondence

The India Office 'Private Papers' at the BL contains a file of a small number of letters written by Clements Markham to Richard Henry Major (1818-91)[74] in which he mentions the progress of the cinchona experiment, and refers to the production of his 1866 map of the Nilgiri cinchona plantations (see below). There is also a single letter from William Hooker to Herman Merrivale (under Secretary of State for India), from 1860 noting the early preparations made at Kew for the project.

The papers of the Denison family of Ossington, Nottinghamshire, held in the MSCN, include three letters which refer to their cinchona interests on the Nilgiris (in the form of the Ossington, Welbeck and Belmont estates). Linked material related to the estates was also found at NCA. Sir William Denison (Governor of Madras 1861-66) was enthusiastic about the Nilgiris generally and the British cinchona project more specifically. His brother Charles managed the family's Nilgiri estates. This small collection of letters is one of few sources for privately owned cinchona estates, but offers of course only a partial picture, and the Denison family's high social standing is probably atypical of planters as a whole.[75]

The papers of William Henry Cavendish-Scott-Bentinck, 4th Duke of Portland (1786-1854) in the Portland (Welbeck) Collection were also consulted in the MSCN as they include letters from Bentinck written from the Nilgiris where he resided to recover from illness in the early 1830s. The papers of Bishop Frederick Gell (Bishop of Madras 1861-1899) held in DRO, also proved useful in gathering descriptions and records of personal experiences on the Nilgiris.

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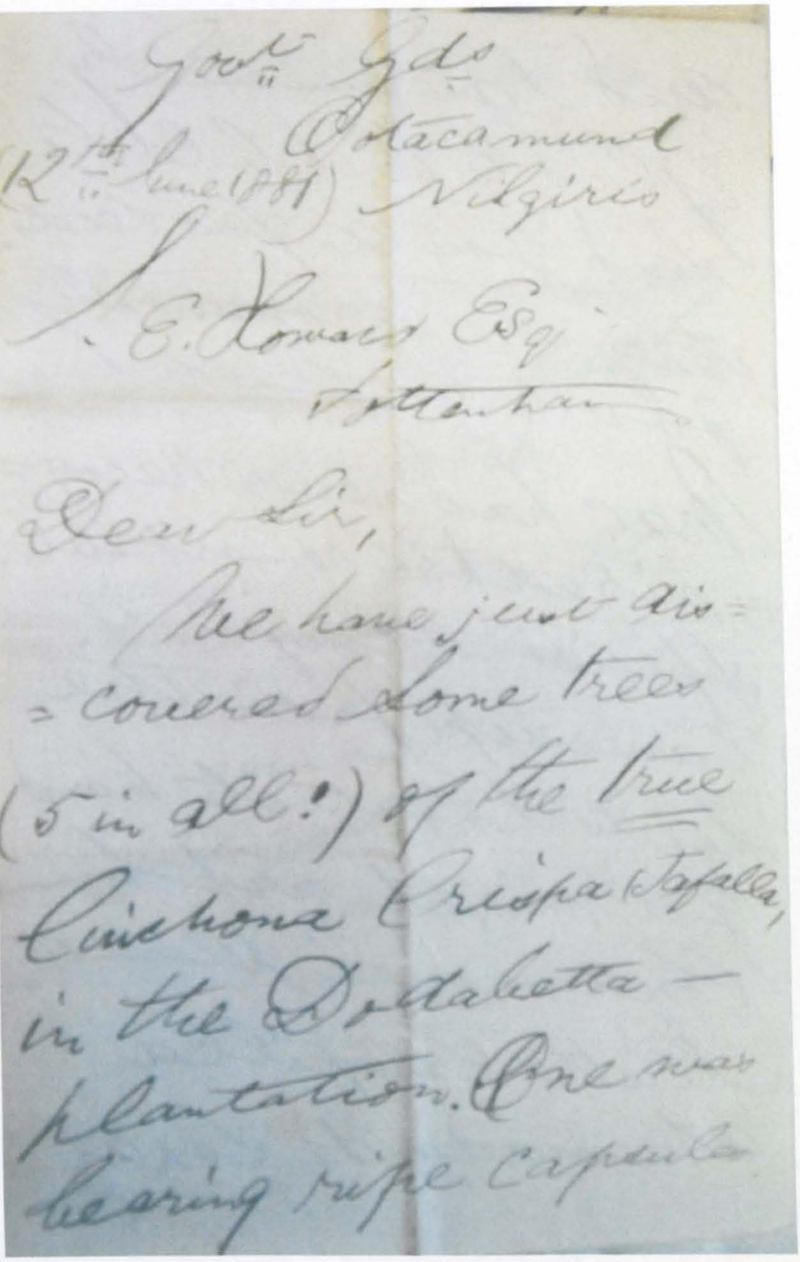
[74] Keeper of Maps and Plans at the British Museum 1867-80.

[75] Although all planters would have needed access to a substantial amount of capital to open their plantations, most appear to have had a long-term association with the Nilgiris, investing as settlers rather than to make money quickly and return home.

The largest collection of private correspondence utilized in the study comes from the RBGK. Their JEH collection comprises approximately 70 letters written to John Eliot Howard the quinine manufacturer and Quinologist. The majority are from Robert Cross (a gardener of strong and often controversial opinions who made several expeditions to South America to procure cinchona plants and seeds, and who also visited the plantations on the Nilgiris, see figure 3.1), but there are also contributions from Clements Markham, Anne McIvor (wife of William, Superintendent of the Government Cinchona Plantations on the Nilgiris), Richard Spruce (plant collector), and Herman Merrivale (India Office). These handwritten personal letters reveal the complex movements and exchange of letters, plants and expertise around the world, and the personal frustrations of Robert Cross which are often hidden from the official record. However they present a largely one-sided conversation as Howard's replies are in the main absent, and at times the letters can be difficult and time consuming to decipher, with their context sometimes not immediately apparent.

Another group of over 200 letters relating to all aspects of cinchona cultivation on the Nilgiris are mainly addressed to Joseph Hooker and other members of the Kew authorities. These are bound in two Miscellaneous Reports 'scrapbook style' books (alongside printed material). They include letters of instruction from the India Office, contributions from Markham, Robert Cross, and John Eliot Howard, copies of telegrams, and copies of letters sent out by the Kew directors and others entrusted with some role within the experiment, and cover the entire study period. Through these letters it is possible to trace the development of smaller stories within the ambitious experiment, and to get a sense of the characters caught up within the confusion.

Figure 3.1 – Sample Letter Extract from the JEH Collection at RBGK. Letter from Robert Cross to J.E. Howard, 12th June 1881[76]


Govt Gdns
Ootacamund
(12th June 1881) Nilgiris
J.E. Howard Esq
Tottenham

Dear Sir,
We have just dis=
=covered some trees
(5 in all!) of the true
Cinchona Crispa Jafalla,
in the Dodabetta —
plantation. One was
bearing ripe capsules

Source: RBGK, JEH/1/37.

ii) Diaries

The Sir Clements Markham Collection at the RGS is comprised of 15 boxes of 90 files. Included amongst them are his three 'cinchona notebooks', where he recorded the events of his collecting mission and the preparations for it, and his personal

76 Here Robert Cross is writing from the Government Gardens at Ootacamund where he has remained since escorting some cinchonas from the RBGK to the Nilgiri plantations. He explains to Howard that he has just discovered what he believes to be some of the true *Cinchona crispa jafalla* in the Dodabetta plantation.

diaries of expeditions as well as some penned by his wife Minna. These items contain detailed information on the transfer of cinchona to India. The diaries of husband and wife include daily entries of updates on the precious plants, and the latest weather, alongside social engagements. Markham's notebooks are relatively well known, but the items written by Minna are, to my knowledge, relatively unused by researchers.

Published Sources

i) Plantation Reports (AARs)

The *Annual (Administration) Reports of the Government Cinchona Department, Nilgiris, Madras* are the major source of information regarding operations on the government run cinchona plantations. Earlier reports also function as the annual report of the Government Botanic Garden at Ootacamund. Compiled by the Superintendent of the government cinchona plantations, with additional comments from the Quinologist (at times when they were in place), the format of these printed yearly reports is broadly consistent over time, and they are available for the whole of the study period (1860-1900) and beyond. They report on the season and rainfall, financial receipts and expenditure, the general condition of the government estates and their upkeep, the nurseries, the harvest of bark and stocks kept, the buildings, labour, and in later years the operations of the quinine factory. The written report (somewhat variable in length), is followed by a series of tables which chart the development of the plantations in statistical form. A rich source of information, it is surprising that the annual plantation reports have been relatively little utilised in studies of cinchona to date.

As the 'official record' of the Nilgiri plantations, the AARs were issued to fulfill a government requirement, and extracts were published in newspapers in India and Britain to inform the general public of progress in the experiment. The Superintendent was thus under pressure to produce positive results, perhaps influencing the wording of the report or encouraging the manipulation of figures. We cannot therefore believe the information they contain without some level of scepticism, and wherever possible the information they contain has been used in combination with other sources. The AARs however remain the most important body of material on the course of the British cinchona experiment as it played out on the Nilgiris. The RBGK hold the AARs covering the official years 1874-1875 to 1900-1901, with earlier reports published in the BPP. Copies of the reports from 1892-1942 are available in the Oriental Collections (formerly India Office Records) of the BL.

Before the establishment of the cinchona plantations on the Nilgiris, and after the founding of the Government Botanical and Horticultural Gardens at Ootacamund in 1848, Superintendent William McIvor issued reports on the garden's progress and activities annually. The BL holds several of these dating from 1853-1860.[77] Comments from other botanists, (most notably Hugh Cleghorn)[78] on the reports are present for some years alongside several maps. These reports are an important source on McIvor's early ambitions for the garden and the results of initial experiments in acclimatization, also hinting at the possibilities for cinchona on the Nilgiris.

ii) British Parliamentary Papers (BPP)

The cinchona 'Blue Books' (or Parliamentary Papers) for 1852-1875 are now readily available online (figure 3.2) as part of the digitized Commons Parliamentary Papers 1801-2004, and are easily searchable,[79] which has allowed for a fuller engagement with the source than would have previously been possible. Hard copies are available in many of the national archival institutions including the BL, WL and RBGK.

'Blue Books' are volumes of official nineteenth century BPPs or correspondence related to a specific theme, available for many colonies, and so named because of their blue paper covers. Preston (2006-2007) describes the Blue Book as, "the most significant single resource of information" on the British Empire in the nineteenth and twentieth centuries. Four volumes (see appendix D) are devoted to Indian cinchona and contain a wealth of data – both qualitative and quantitative, of direct relevance to my study. Briefly, they contain copies or extracts of all official letters regarding cinchona on the Nilgiris, cinchona collecting expeditions, monthly reports on the Nilgiri plantations for the early years of the experiment (including

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[77] There are also some later reports, under the title *Annual Administration Report of the Government Botanical Gardens and Parks, Nilgiris*, dating from 1892-1922 in BL. IOR/V/24/1689.
[78] See appendix B for a short biography.
[79] See http://parlipapers.chadwyck.co.uk/home.do [Accessed 16/01/10].

simple statistical information presented in tabular form), information regarding cinchona propagation, cultivation and the harvesting of bark (including some diagrams), results of chemical analyses performed on the bark, and updates on the concurrent Dutch cinchona experiment. Similar volumes have been used to research the introduction of tea to India (see Sharma, 2009).

Chosen to constitute the 'official' record, there is no doubt that at times the compilers of the Blue Books would have been somewhat 'selective' over the items they chose to include. These Blue Books were after all published and widely available for public consultation shortly after the events they portrayed. In private correspondence, Richard Spruce (an important cinchona collector) noted the absence of some of his own letters in the published Blue Books.[80] However, like the annual reports, the Blue Books remain an important source of information. They have been more widely used that the plantation reports, perhaps owing to their greater ease of access (see Honigsbaum, 2001).

Other Blue Books also contain snippets of valuable information on cinchona (i.e. those focusing on the moral and material progress of India), the online search facility making these items relatively easy to find. The establishment of a military sanitarium on the Nilgiris (an important section of chapter 4) also has a dedicated Blue Book.

[80] Letter from Spruce to J.E. Howard, dated York, 5th July 1869. RBGK. JEH/1/11.

Figure 3.2 – Parliamentary Papers (Blue Book). East India (Chinchona Plant). Copy of Correspondence Relating to the Introduction of the Chinchona Plant into India, and to Proceedings Connected with its Cultivation, from March 1852 to March 1863.

[1]

COPY of CORRESPONDENCE relating to the Introduction of the CHINCHONA PLANT into *India*, and to Proceedings connected with its Cultivation, from March 1852 to March 1863.

— No. 1. —

From the Governor General of India to the Court of Directors of the East India Company.

Honourable Sirs, Fort William, 27 March 1852.

WE have the honour to submit the accompanying letter from the Government of Bengal, with its enclosures, and to recommend for the early consideration of your honourable Court the proposal therein made for deputing a qualified gardening collector from England to South America, to procure an ample supply of seeds and young plants of the best species of the quinine-yielding cinchonas, with a view to their introduction into India.

We have, &c.
(signed) *Dalhousie.*
F. Currie.
J. Lowe.

— No. 2. —

MINUTE recorded at a Revenue, Judicial, and Legislative Committee of the Directors of the East India Company, 16 June 1852.

THE Committee having had before them a letter from the Government of India in the Public Department, dated the 27th March (No. 18) 1852, with its enclosures, recommending compliance with the proposal of the Governor of Bengal for deputing a gardening collector from England to South America for the purpose of procuring a supply of seeds and plants of the best specimens of the quinine-yielding cinchonas, with a view to their introduction into India, —Ordered, that the above papers be referred for the consideration of Dr. Royle, with a request that he will furnish this Committee with his sentiments as to the measure therein recommended, together with his opinion as to the probable expense of carrying it into execution.

— No. 3. —

REPORT on the Introduction into *India* of the Quinine-yielding Cinchonas, or Peruvian Bark Trees, by Dr. *Royle.*

India House, 27 June 1852.

AMONG the vast variety of medicinal drugs produced in various parts of the world, there is not one, with probably the single exception of opium, which is more valuable to man than the quinine-yielding cinchonas. The great value of Peruvian bark as a medicinal agent was universally acknowledged very shortly after it became first known in Europe. Its utility and employment have been greatly increased ever since its active principle has been separated in the form of quinine. So great indeed has the consumption increased, and so little care

118. A has

Source: http://parlipapers.chadwyck.co.uk/home.do [Accessed 16/01/10].

iii) Commercial Industry Records

The government cinchona experiment prompted a number of private individuals to try their hand at cinchona planting, or to form or invest in limited companies engaged in cinchona cultivation. Within the records of the Board of Trade files of dissolved companies at TNA are a number of records for companies involved in cinchona and quinine production and distribution. Two of these were based on the Nilgiris,[81] the *Western Neilgherry Coffee, Tea and Cinchona Plantation Company Ltd* (registered 1862), and the *Nilgiri Gold and Cinchona Company Ltd* (registered 1880). A similar but larger file for the *Nilgiri Tea and Cinchona Company* (established 1877) was located in the NAS. The files of these registered stock companies begin with the official notification of the registration of the company, which includes the names of the founding directors and shareholders, the capital of the company and some information regarding the location of operations. This document is followed by yearly returns to the Board of Trade noting the details of the uptake of shares. The final item in each of the files is the notice of winding up of the company. Although in many ways a one-sided record of correspondence (particularly in the case of unsuccessful companies who failed to submit annual returns), these files provide valuable and so far ignored, information relating to the private cinchona industry on the Nilgiris.

The LMA is rich in material relating to John Eliot Howard (government Quinologist) and his work on cinchona, particularly that which he carried out as part of the Howard family firm who manufactured quinine products alongside a variety of other drugs.[82]

iv) Newspapers

The Nilgiris has long held a close association with the popular press (figure 3.3). As Francis explained in 1908,

[81] Several others were based on the island of Ceylon, and a file at the NAS relating to the Tjoekoel Tea and Cinchona Company (B72/7592) shows that British individuals also invested in cinchona on the island of Java.
[82] I am very grateful to Dr. Mark Nesbitt of the RBGK for providing me with copies of a number of these items.

> Ootacamund has had its full share of newspapers... Except the *Ooty Times*, which during its short life aspired to a daily edition, all of them have been published either weekly, twice a week, or three times a week. The *Neilgherry Excelsior* was incorporated at the end of 1871 with its rival the *South of India Observer and Agricultural Times*. The second part of the title of this latter was due to its devoting much space to the interests of the planting community, who for some time poured forth their grievances regularly in its columns. It did useful work in promoting the protection of the game birds and animals on the hills and in its columns appeared the well-known series of letters on that subject by General Richard Hamilton ('Hawkeye') ... In 1873 its title was curtailed to *South of India Observer*, but it continued to devote special columns to matters connected with tea, coffee and cinchona and published a weekly 'Planters' sheet' in which articles from other sources on these subjects were reprinted. In 1894 it was incorporated with the *Nilgiri News*, which also set itself to cater specially for the planters (Francis, 1908:265-266).

Figure 3.3 – Nilgiri Newspapers

Name.	From	To
Eclectic and Neilgherry Chronicle	1860	1861
Neilgherry Star	1862	1863
Neilgherry Excelsior	1863	1871
South of India Observer and Agricultural Times ..	1867	1873
South of India Observer	1873	1894
Sathiabothini, a Tamil monthly periodical	1873	1874
Neilgherry Courier	1873	1876
Ooty Times	1884	1885
Nilgiri Express	1886	1889
Nilgiri News	1893	1902
South of India Observer	1902	...

Source: Francis, 1908:265.

The BL holds issues of the *South of India Observer* (*SIO*) from the 6th January 1877 to 30th December 1893, and the *Nilgiri News* from 2nd January 1897 to 2nd March 1902, with the *SIO* returning from 6th March 1902 to the 26th December 1914, with scattered issues missing throughout the series. Unfortunately holdings of the early papers (which coincidentally begin in the same year as the arrival of cinchona on the hills) have not been traced.

The *SIO*, published at Ootacamund, is therefore the primary newspaper source for cinchona on the Nilgiris. The publication frequency varies from weekly to tri-weekly editions over the study period, and includes occasional supplements, but for the most part is published on Wednesdays and Saturdays, the Wednesday edition containing more information on planting matters. Over a thousand issues were read on microfiche for relevant information. This provided a wealth of information. The classified section lists cinchona estates, plants and seeds for sale (or wanted) and many column inches are devoted to the local and national weather, political events, and incidences of disease and their implications for planters and their plantations. Reports from the London bark auctions feature regularly, and often prompt further written discussion, whilst letters to the editor discuss the intricacies of planting and harvesting. The *SIO* also often included edited highlights of the most recent cinchona and botanical garden reports from the Nilgiris, Darjeeling, Ceylon, Java and London, and extracts from British and other Indian newspapers on subjects of relevance to the hills. The arrival and departure of prominent people can also be traced.

Judith Kenny and Alexander Morrison draw on the *SIO* archive in their respective studies of the Nilgiri Hills, but the newspaper has not previously been used as a primary resource for researching the cinchona plantations. As Morrison explains,

> ...a great deal of light is shed upon Nilgiri society by the letters and articles in the grandly titled South of India Observer or Nilgiri News, jointly Indian- and British-owned for most of this period [1850-1900], but which circulated largely amongst Europeans, who were also the main contributors...This source obviously has its limitations – in general it represents the views of Europeans, and amongst them those of the planting interest (with some exceptions), though these are far less consistent than might be expected (2004:58).

The *SIO* was produced for the British population residing on the Nilgiris, and is therefore biased towards the inclusion of matters relating to its target audience, often depicting them and their activities in a positive way and in the process neglecting news of relevance to the indigenous tribes of the region. The accuracy of the information the newspaper contains cannot be guaranteed, and we know little of whom the editorial team was.

The Times and *The Scotsman* digital archives were also searched online, generating a small number of articles of interest including the short updates of the Nilgiri experiment that were relayed to the British audience back home. A wider online search of nineteenth century British newspapers produced 1,150 hits for 'cinchona' published between 1850 and 1900, though very few of these are articles of any substantial length, many being advertisements for pharmaceutical products.

Obituaries in horticultural magazines like *The Gardener's Chronicle* have also been utilized for biographical information on the main characters involved in the experiment. Obituaries are necessarily selective in the amount of information they contain, and cannot therefore ever truly present an accurate resume of a life. Referring to the obituaries printed in the *Annals of the Association of American Geographers* and *Transactions of the Institute of British Geographers*, Keighren explains how,

> Untrammeled by the requirements of scholarly biography, these obituaries, memorials, and eulogies are often intimate, personal, and humorous – attending to the 'warp and woof of a life'. The obituarist and biographer occupy a position of power, and are able to 'reorder and reconstruct the subject's life'. Responsible for the written record, they enjoy a freedom to locate (or not) their subject within the discipline's history, and, by so doing, to colour subsequent biographical appraisals. The same individual might, then, be represented in different ways; co-opted to fulfill specific and imposed roles – hero, nationalist, pioneer (2007:49).

However obituaries remain useful for establishing key dates (although inaccuracies are not infrequent) and basic biographical information, alongside a sense of whether and how the individual will be remembered and why. The major text of British collective biography, the *Oxford Dictionary of National Biography* (ODNB) (now available online) has been used to gather further information on the individuals involved in the British cinchona experiment. In her paper on the new edition of the ODNB, Baigent explores specifically how its preparation offered the opportunity "For reflection on the geography of the original work and on the biography of geography as told in the dictionary" (Baigent, 2004:532). In much the same way as the ODNB is "The history of the nation told through the biographies of those who had shaped its national life" (Baigent, 2004:533), this study of the cinchona experiment is largely reliant on the life stories of a number of key characters who shaped the experiment (appendix B).

v) Scientific Periodicals

As a botanical and in many ways a chemical experiment, progress was regularly published in the scientific periodicals. *The Pharmaceutical Journal* provides the most comprehensive account of the project, particularly in terms of cataloguing the chemical analyses of bark (usually performed in London). A complete back-catalogue of the journal is held at RBGK where articles of interested were photocopied. The medical journal *The Lancet* also contains a number of pieces on the cinchona experiment and was consulted at the Greenfield Medical Library, University of Nottingham.

vi) Planting Directories

Planting directories have been a valuable source of information, particularly relating to privately owned cinchona estates, for which there are few other sources available.[83] The BL holds a collection of planting directories for Southern India (covering the period 1878-1965) where statistics are organized by district. These have been utilized to establish a picture of the number and size of cinchona estates over the study period, their changing ownership, and their prominence in relation to other plantation crops (predominantly coffee and tea). A number of tourist guides to Ootacamund and the Nilgiris (see below) also provide lists of estates as appendices.[84] Unfortunately these directories provide very minimal information on specific location (detailed maps are absent from the directories). The accuracy of the figures also cannot be established in any certainty, the compilers often commenting on their reliance on the planters to provide accurate information. Different volumes also use different regional divisions, obscuring the picture of cinchona growth and decline on the Nilgiris. The planting directories have hitherto been underused in uncovering the history of planting in the Nilgiri District.

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[83] It now appears likely that plans of some of these private cinchona estates exist in the records of the Collectorate at Ootacamund (see Sutton, 2009).

[84] I am grateful to Alexander Morrison from the University of Liverpool for providing me with planting statistics from a rare guide to the Nilgiris, see Anon (1877).

vii) Nineteenth Century Books

a) Cinchona Manuals

Many of the key players (for example Superintendents of the plantations in both the Madras and Bombay Presidencies, and those invited to inspect upon them) in the British cinchona experiment published manuals on cinchona cultivation in which they issued technical advice on methods of propagation, the laying out of plantations, and harvesting bark (table 6.2). Copies can be found scattered through London's archival repositories. It remains unclear as to whether writing these types of manuals was an expected requirement for professional botanists, but either way, these published manuals are an important source for tracing shifts in thinking on cinchona cultivation matters, alongside professional and national differences in opinion. To date there has not been any specific engagement with them. Many shorter papers, reports and pamphlets were compiled along similar lines, with cinchona collectors also making significant contributions, usually publishing accounts of their collecting missions in South America.

Markham's *Travels in Peru and India* (1862), and *Peruvian Bark: A Popular Account of the Introduction of the Chinchona Plant into British India* (1880) are larger volumes centred on the transfer. Present in a number of the national archives, Markham's books are biased towards depicting his own, and wider British success, but nevertheless are useful sources on the project. Philip (1995, 2003) uses *Travels in Peru and India* to explore the possibilities of reading environmental histories as "literary, cultural, ideological and political narratives" (2003:179). John Eliot Howard's *Quinology of the East Indian Plantations* (1869-1876) is the only other major text devoted to the Nilgiri cinchona plantations, scientific in nature but heavily illustrated with botanical drawings of numerous species and varieties of cinchona, also containing the only known photographs of the government plantations at Dodabetta and Naduvattam (figures 6.14 and 6.15).

Very few of the nineteenth century Nilgiri planters (of cinchona or otherwise) appear to have published any kind of memoir. James McPherson's *The Neilgherry Tea Planter* (1870) and Robert Henry Elliot's *The Experiences of a Planter in the*

Jungles of Mysore (1871), and *Gold, Sport and Coffee Planting in Mysore*[85] (1894), being the only examples traced.

b) Tourist Guidebooks

The town of Ootacamund is most well known as a nineteenth and early twentieth century popular British retreat and summer holiday destination (see chapter 4). 'Ooty' quickly became an important stop on any traveller's itinerary, a development which resulted in the publication of a number of guidebooks to the area. The first of these was published by the town's medical officer Robert Baikie in 1834, and focused on the healthful qualities of the hills, issuing notes of guidance for who would benefit from visiting, alongside instrumental meteorological data. Robert Mignan's *Notes extracted from a private journal, written during a tour through a part of Malabar, and among the Neilgherries...* was published the same year. This was followed by the official *Report on the Medical Topography and Statistics of the Neilgherry Hills* (Government of Madras, 1844), and *Remarks on the Climate, with Advice to Invalids and Others visiting the Neilgherry Hills* by George Mackay (1870), formerly senior resident medical officer at Ootacamund.

As the popularity of the town and its surrounding hills increased, more typical guidebooks appeared. These include; Geofry's *Ooty and Her Sisters* (1881), Nicholl's *A Guide to Ootacamund and its Neighbourhood* (1889), and *An Illustrated Guide to the Nilgiris with descriptions of Ootacamund, Coonoor etc* published in 1877, 1905 and 1912 by Higginbotham and Company (a publisher which is still based in Madras today and still has two branches of its bookshop in Ooty), as well as Davis' *"Observer" Guide and Year Book to the Nilgiris* (1920). These guides typically include some or all of the following; lists and descriptions of places of interest (sometimes including the cinchona plantations), foldout maps of the settlement, and lists of current residents and plantations. More personal reflections on the town can be found in Marryat (1868), and Stone (1925).

[85] The Princely State of Mysore neighbours the Nilgiri District, and Elliot is known to have cultivated cinchonas on his estate for a time.

These guides have been used alongside Frederick Price's *Ootacamund: A History* (1908), and *The Nilgiris District Gazeteer* compiled by Francis (also 1908) to trace the development of British Ootacamund, and the associated planting industries. More recent reflections on the legacy of British occupation of the town by Panter Downes (1967) and Weeks (1979) have also been consulted.

The intrigue surrounding the indigenous tribes of the region has resulted in the publication of a significant body of anthropologic literature focusing on them and their homes, which provides context both for the Nilgiris before the arrival of the British, and their subsequent interactions with the indigenous peoples, one group of which – the Badagas – were subsequently employed on the cinchona plantations. As Hockings (1989a:*vi*) discovered, "The total of some 3,000 books and articles yields a density of over three publications per square mile – one could almost literally paper the district with them – and shows this [the Nilgiris] to have been perhaps the most intensively studied part of rural Asia east of the Holy Land". Examples include Shortt (1868, 1869), Harkness (1832), and Rivers' (1906) seminal study *The Todas.*[86]

Another group of published texts relates specifically to botany in the hills (see Landolicus, 1881 and Pogson, 1872) which contain useful information concerning the value assigned to English-type gardens in India and their role in the recreation of home, also providing a context for the transfer of cinchona to the Indian hills.

3.3.2 <u>Non-textual Sources</u>

i) Oral Histories/Private Archives

All of those involved in the British cinchona experiment are long dead, and in some cases largely absent from the official record. However their descendents can offer a unique (yet understandably biased) perspective on their ancestor's character and activities. The great-great nephew of cinchona collector Robert Cross, William Cross was traced through internet search and visited in May 2009 where he was enthusiastic about sharing recollections and family anecdotes, some of which he has published in local history magazines (Cross, n.d.), at one time hopeful of making a

[86] See Cederlof (2002) for a 'revisting' of these texts and an exploration of how indigenous peoples of the Nilgiris (particularly the Todas) have been represented through history.

film based on his great-great uncle's adventures.[87] This meeting brought Robert Cross to life, an interesting character who had a fractious relationship with the India Office, a man not afraid to voice controversial views and who felt somewhat hard done by in terms of financial rewards for his efforts. Doing justice to the tireless efforts of Cross and others thus became paramount in the writing up process.

ii) Bark samples

The traditional archive is overwhelmingly biased towards the collection and conservation of text based sources, yet perhaps more important in the cinchona experiment (certainly during the time) were the exchanges of plant material (both living and dead). Over 900 cinchona bark samples are now housed in the Economic Botany Collection at Kew, 147 of which originate from India and a significant proportion of which were either grown in the Nilgiris or at other sites within the British cinchona network. Examination (and photography) of these allowed a more in-depth personal association with the experiment (figure 3.4).[88] As Hamilton *et al.*, explain:

> Where previously historians 'mined' the archives for 'nuggets of fact' in a manner conscious of problems of bias in the record, today scholars pay greater attention to the particular processes by which the record was produced and subsequently shaped, both before its entry into the archive, and increasingly as part of the archival record. This approach draws attention to the way in which the record is altered over time, as well as to the gaps and omissions in, and excisions from, the record (Hamilton *et al.*, 2002:9).

[87] William Cross also kindly gave me copies of letters from the Kew collections relating to Robert Cross and the rubber transfer which mention cinchona, which I would otherwise have missed.
[88] Also see Prendergast, 2001 and the website listing of the bark specimens compiled by Mark Nesbitt: http://www.kew.org/collections/ecbot/collections/topic/cinchona/cinchona-collections/bark-specimens/index.html [Accessed 16/01/10].

Figure 3.4 – A Sample of Renewed *Cinchona officinalis* Bark Grown on the Nilgiris and Forwarded to J.E. Howard for Analysis, 1874

Source: RBGK Economic Botany Collection. Catalogue No. 52305. Photograph by author.

iii) Drawings, Paintings and Photographs

General views of Ootacamund (in photographic and drawn or painted form) are found widely and numerously throughout the different archives. Many visitors to the hills chose to remember their trip through some kind of pictorial record. Collections include offerings by amateur photographers and artists, and also some examples by professional and commercial photographers like Samuel Bourne, landscape photography being a "powerful means of organizing and domesticating imperial landscapes" (Ryan, 1997:26). Specific landscapes, buildings and events are popular subjects. For example the Ootacamund Club, and its organised jackal hunts are particularly well represented in the photographic archive of both the RGS and BL (the 'Photographs' collection of the India Office Select Materials catalogue lists 194 photographs of Ootacamund). Ryan comments that in the tropics, prey was "Often shot by the camera only moments before being shot with the rifle" (1997:138). Indigenous peoples and their homes were another focus for the photographic gaze (figures 4.3, 4.4 and 4.5).

These photographs "…composed, reproduced, circulated and arranged for consumption within particular social circles in Britain – reveal as much about the imaginative landscapes of imperial culture as they do about the physical spaces or people pictured within their frame" (Ryan, 1997:19-20). Or, as Bartram (2003) explains, these images should not be taken as straightforward reflections of reality, and should instead be read as 'cultural signs', taking into account the production of the images, its aesthetics, and audience engagement with the image.

There are 55 items relating to Ootacamund in the 'Prints and Drawings' subset of the India Office Select Materials in the BL. These include an extensive number of watercolours by George Hutchins Bellasis (1807-1862) (figure 3.5), and two scrapbooks by Sir Richard Strachey (1817-1908);[89] documenting his voyage out from England to India, and holidays in the hills. The WL holds a copy of Major Stephen Ponsonby Peacocke's *Views in the Neilgherry and Koondah Ranges, Western Ghauts, Madras, at and about the Stations of Ootacamund and Coonoor, and the Segoor, Koondah and Conoor Passes* (1847) (figure 3.6).

Images raise similar questions to texts concerning production and purpose. Paintings and drawings should not immediately be taken as accurate as they are wide open to manipulation by the artist who may have added desirable landscape elements and conversely, conveniently 'left out' undesirable features. Ryan (1997), Driver and Martin's edited volume (2005) and Stepan (2001) all primarily utilise the visual archive of tropical travel, exploring the visualisation of the tropical landscape from a European perspective and offering guidance for the study of images. The production of images (both hand drawn illustrations and mechanically produced photographs) was central to the study of medicinal topography, botany and medicine.

Images were of course expensive to produce in the nineteenth century and are therefore largely absent from the newspapers of the time. *The Illustrated London News* (*ILN*) is however a rich pictorial source for the nineteenth century. Two illustrated articles on Nilgiri cinchona appear in the magazine,[90] (figures 6.9 and 6.11) and importantly provide a pictorial representation of the cinchona plantations.

[89] For more on Strachey, see Vetch, 2004.

[90] The first image from the magazine was found after a search of the WL's image collection, and inquiries then traced the illustration back to the magazine. An amateur online catalogue of the ILN enabled the other article and accompanying image to be found.

Figure 3.5 – The Club House, Ootacamund, 1852 by George Hutchins Bellasis

Source: British Library/Heritage-Images
http://www.heritageimages.com/Preview/PreviewPage.aspx?id=1222689&licenseType=RM&from=search&back=1222689 [Accessed 16/01/10].

Figure 3.6 – View at Ootacamund, Neilgherries by Stephen Ponsonby Peacocke

Source: http://gibberandsqueak.blogspot.com/ [Accessed 16/01/10].

Photographs are less open to manipulation but do only show a selected view at a selected time, and are therefore not neutral in their gaze. Photography has a central place in the imaginative geography of the Empire, its invention and development (from 1839) concurring with the extraordinary expansion of Britain's overseas Empire (Ryan, 1997). Viewed by many Victorians as, the perfect marriage between science and art, photographs allowed the author to record nature with accuracy, and for their productions to also perform an educational role. "As one of the key wonders of the Victorian age photography was thus widely regarded as a most powerful means of revealing the realities of the world and Britain's expanding presence in it" (Ryan, 1997:16). Given their appearance in the tourist guidebooks of the latter nineteenth century, it is somewhat surprising very few photographs of the cinchona plantations and the individuals involved in their management have been discovered in the archives (the only known ones appear in Howard, 1869-76). Either they somehow escaped the camera lens, or have subsequently been lost, destroyed, or remain outside of the official archive. The RBGK also holds a small number of photographs of great interest, depicting the arrival of one of the first batches of the trees at Ootacamund, and Howard's cinchonas at his greenhouse in Tottenham. Cinchona plantations elsewhere feature more frequently in the photographic record. A set of 90 lantern slides held at the BL, depict the cultivation of cinchona and the manufacture of quinine sulphate on the Bengal Government Cinchona Plantations during 1906-16, and can be used to gather a sense of similar processes undertaken earlier on the Nilgiris (figure 3.7). Images of the Ceylon plantations have proved invaluable in gaining a sense of what it meant to be a labourer on a cinchona plantation (figure 7.2).

Figure 3.7 – Collecting Cinchona Bark, Munsong

Source: Wellcome Images and BL India Office Select Materials, Photo 397.

iv) Maps and Plans

As Bell *et al.* explain; "The principal geographic 'tool' was the map. By representing the huge complexity of a particular physical and human landscape cartographically in a single image, geographers provided the European imperial project with arguably its most potent device" (1995:4). Ootacamund and the wider Nilgiri region was subject to cartographic survey from the early nineteenth century,[91] and although there are national scale maps showing the native and proposed homes of the cinchona within India in Markham's books and the BPP, there are very few maps showing the Nilgiri cinchona plantations in any detail. The only map created specifically to chart the development of the cinchona industry on the Nilgiris is Markham's *Map of the Neilgherries, Koondahs, and Wynaad to illustrate the progress of chinchona cultivation up to July 1866*, now held at the BLO. The only previous engagement with this uniquely important source is Folke (1966) who uses it to chart the evolution of the plantation industry, in-migration and population growth and composition in the Nilgiris and the neighbouring district of Coorg. Maps are conspicuously absent in the annual plantation reports. The government plantations

[91] See Hockings (1962, 1978) for a comprehensive bibliography of local maps of the region, and Prabhakar and Gadgil (1996) for an example of work using maps of the Nilgiris as markers of ecological change.

and other named private estates appear on the Ootacamund Hunt maps of 1913 and 1920, and are available in both the BL and the BLO. Maps are usually expensive and time consuming to produce and were, therefore, most often produced to serve distinct purposes, often having both symbolic and practical importance to imperial rule.

Plans of the cinchona propagation houses at both Kew and Ootacamund have also been consulted.

3.4 Field Study

3.4.1 Ootacamund and the Government Botanical Gardens

A visit to Ootacamund in April 2007 served to compliment subsequent archival research, taking the view that it wouldn't be possible to research the place effectively not having being there. During the stay in Ootacamund, the sites of the sprawling town were taken in and visits made to places which held great importance in the cinchona experiment, including the Ootacamund Club and Government Botanical Gardens. The gardens remain a popular tourist spot, attracting around 20 million visitors every year (figure 3.8). Having made contact with Dr. Ramsundar at the gardens prior to arrival ensured that the visit was enriching. Although no cinchona was growing in the gardens, Dr. Ramsundar arranged visits to the former government plantations. Exploration of the small library at the gardens revealed surprising very few texts relating to cinchona. A visit to Nilgiri Library[92] (established in 1829 after John Sullivan (see chapter 4) initiated a subscription (see Hockings, 1989b)) was more fruitful in this respect. In 1920 Davis wrote of the Ootacamund Library, "It is, next to the library of the Madras Literary Society, the most complete and best stocked library in Southern India. On its tables in the main hall will be found all the leading and most popular English weeklies and Monthlies – illustrated papers, magazines and reviews – as also popular English daily newspapers" (1920:72).

[92] For a short history of the library see Ganjoor and Burza, 2003.

The Ootacamund Club[93] (still referred to by many residents as the location of 'snooty Ooty' and the place where snooker was invented) was, during the cinchona experiment, a popular social retreat for the men of high social standing. As Mandelbaum explains,

> ...the one [club] in Ootacamund was one of the finest in India, complete even to an organized hunt with horses, hounds, horns, master, and all but foxes – jackals had to do. The club provided facilities for interdining and interdrinking, for outdoor sports and indoor recreations, for ritual celebrations, especially in the Christmas season...Elsewhere Englishmen might meet, at the club they mingled... Wives could find the company there that was lacking in houses full of servants but empty of kin (Mandelbaum, 1989:13).

A visit allowed the grand atmosphere of this quote to be experienced and absorbed (figure 3.9).

Figure 3.8 – Ootacamund Botanical Garden, April 2007

Source: Photograph by author.

[93] For contempory reflections upon the Ootacamund Club see Fishlock, 1980 and Panter-Downes, 1967.

Figure 3.9 – The Interior of Ootacamund Club ('Snooty Ooty'), April 2007

Source: Photograph by author.

3.4.2 - The Plantation Sites –Dodabetta and Naduvattam

Accompanied by Dr. Ramsundar, the former cinchona plantation sites at Dodabetta and Naduvattam were visited. At Dodabetta (the highest peak in southern Indian and only a short drive from Ootacamund), Dr. Ramsundar pointed out the cinchona trees which continue to grow on the edges of the site, as well as the old Superintendent's house (figures 3.10 and 3.11), McIvor apparently arriving here on horseback from the botanical gardens. Much of the site remains devoted to growing medicinal and aromatic plants (including geranium, rosemary, thyme, citronella, gaultheria and eucalyptus),[94] and is known as 'Cinchona Village'.[95] Established in a joint collaboration by the Forest Department and an NGO known as HOPE (Health of People and Environment), the site (along with a number of others on the hills) is under the leadership of Vanya Orr,[96] whose family first came to the hills in 1824 and whose grandfather Henry Valentine Ryan worked on the Government plantations for thirty years, rising to the rank of Superintendent. I was lucky

[94] http://www.forests.tn.nic.in/ProjectPrograms/About_medicinal_plants.html [Accessed 16/01/10].
[95] http://www.thehindubusinessline.com/life/2008/02/15/stories/2008021550110300.htm [Accessed 16/01/10].
[96] For more information on Vanya Orr and HOPE see, http://www.resurgence.org/magazine/article2618-Vanya-Orr.html# [Accessed 16/01/10].

enough to meet and talk to Vanya later that day on another experimental and teaching farm. Today eucalyptus oil is the primary product of manufacture at Cinchona Village, although bark from the remaining 'wild' cinchonas is still collected.

Figure 3.10 – Cinchona at Dodabetta M.P.D.A., April 2007

Source: Photograph by author.

Figure 3.11 – 'McIvor's House', Dodabetta M.P.D.A., April 2007

Source: Photograph by author.

At Naduvattam, several hours' drive from Ootacamund, an extensive tea plantation has now replaced the cinchona trees, although the distinctive trees remain scattered along the plantation's boundaries (figure 3.12). The long abandoned quinine factory and jail/bark store (now used as a tea store) were explored (figure 3.13), guided by the chief chemist of the tea factory (TANTEA).[97] Just a couple of turbines remained in the derelict factory, most of its other contents apparently sold off as scrap in the 1960s. Photos were taken at all locations and a field diary completed daily, bringing a renewed sense of engagement with the research project.

Figure 3.12 – Cinchona Trees Line the Boundary of the Naduvattam Tea Plantation, April 2007

Source: Photograph by author.

[97] The Tamil Nadu Tea Plantation Corporation (TANTEA) has its origins in 1968 as a Forest Department Project to provide employment to the people of Indian origin repatriated from Sri Lanka under the Sastri-Sirimavo Pact (1964). TANTEA now holds the largest area under clonal tea in India. See Muthiah, 1993:140, and also Heidemann, 1997:154–158.

Figure 3.13 – (left) The Jail (now tea store) and (right) Quinine Factory, Naduvattam Tea Plantation, April 2007

Source: Photographs by author.

3.5 Conclusion

This study of the British cinchona plantations on the Nilgiri Hills of Southern India draws on material from an extensive 'cinchona archive', the production of which was a result of the experiment's status as an imperial project of the utmost importance. This archival material is wide ranging in form and is held in a number of repositories, some of which, as institutions, have direct relevance to the transfer of cinchona to India. Some of these sources have been utilized by historical researchers before, but none to their full extent and in this combination which allows for a full engagement with the Nilgiri cinchona planters and plantations, which has previously been lacking from the cinchona story.

4 Ootacamund and the Nilgiris

4.1 Geography

The Nilgiri Hills of South India are found in the west of the modern state of Tamil Nadu, forming an elevated table land which rises abruptly from the lowlands below, and is almost completely isolated from neighbouring mountain chains. Formerly part of the Madras Presidency, and bordered by the Districts of Coimbatore and Malabar and the Princely State of Mysore,[98] Ootacamund (now officially known by its Tamil name Udhagamandalam) is the Nilgiri District's capital, standing at 7,500 feet above sea level, and forming an island of temperate climate in the hot tropics (Hockings, 1989a and figure 4.2). It is sheltered by several mountain peaks, the highest of which, Dodabetta, stands at 8,765 feet above sea level. The region gets its name from Nila, 'blue' and giri, 'a mountain.'

> The hills were given this name, according to the legend, because of the shrubby pale-blue wild flower *Strobilanthus kunthiansus*, which capriciously blooms only at intervals of from seven to twelve years but then, deciding to do the whole thing properly, has one enormous outburst of blossom that floods over the slopes like a summer sea (Panter-Downes, 1967:74-75).

The distinctiveness of the Nilgiri plateau has struck many a visitor. "It is clearly an enclave in the sense of having special natural and human characteristics, markedly distinct from those of the surrounding lower lands. Though relatively small in area (12,549 sq. km. in the Nilgiri District) and population (630,169 in 1981), it has been given the broader term *region* by most who have written about it" (Mandelbaum, 1989:2). Mandelbaum expands this idea of the Nilgiris as region or enclave, stating that it functioned as a 'central place' for the colonial British society in South India, "...all the more needed because men and women of that society commonly lived and worked among subject peoples who had to be kept, so they believed, at a clear social distance" (1989:15-16).

[98] For more basic statistical information for the Nilgiri district see: http://www.nilgiris.tn.gov.in/ [Accessed 16/01/10].

Morrison explains that despite their position in the political geography of empire,

> ...with an average population density of no more than 127 per square mile in 1901, less than any other district in Madras, and a main town, Ootacamund, of only 18,500 inhabitants, the Nilgiris were of minor economic and demographic significance, and have accordingly attracted little attention from historians since the publication of Sir Frederick Price's voluminous history in 1908 (2004:54).

The main exceptions are the large number of anthropological studies of the region's indigenous hill tribes mentioned above, and the recent contributions by Morrison himself and Sutton (2009).

Figure 4.1 - Map of the Nilgiris

Source: Foldout from: U.P.A.S.I. (1965). *Planting Directory of Southern India.* U.P.A.S.I.: Coonoor.

The district usually receives rain during both the South West and North East Monsoons, giving an average annual rainfall of 1,910 millimetres per year. Owing to its elevation, maximum summer temperatures are around 25 degrees Celsius (77 degrees Fahrenheit), falling to a winter minimum of 2 degrees Celsius (36 degrees

Fahrenheit).[99] A *Report on the Medical Topography and Statistics of the Neilgherry Hills* from 1844 described the Nilgiri weather year in more detail,

> In January, February and March, a north-east wind prevails, during which the sky is clear and serene, the air is cold and bracing, and the whole climate at that period is felt to be highly delightful, and invigorating. In April and May, the weather is showery, but the air continues temperate, and notwithstanding the showers, it is on the whole dry. The winds are chiefly from the north. In June, the south-west monsoon sets in; on the hills, however, the direction of the wind is chiefly westerly, and even to the north of west. The climate then becomes and continues rainy, till well on in December, and the air during that period is felt to be humid. The rains are sometimes heavy and continued, but not in a degree equal to what is observed on the coast of Malabar... (Government of Madras, 1844:28).

The same report also demonstrated that although the quantity of rainfall observed on the Nilgiris was nearly double that observed in Great Britain (44 inches compared to 23), the number of days where rain fell was much less, at only 160 compared to 237 (1844:27).[100]

These temperate conditions, "...within the limits considered by all authorities, most favourable to the European constitution" (Government of Madras, 1844:27), combined with a landscape of rolling hills judged to be typically 'English', were the major factors in serving to popularise the region amongst the British in India (see below). "'Imagine,' Lord Lytton, Viceroy of India from 1876 to 1880, wrote ecstatically to his wife while staying at Government House in this 'paradise' – as he, too called it – 'imagine Hertfordshire lanes, Devonshire downs, Westmoreland lakes, Scotch trout streams... Such beautiful *English* rain, such delicious *English* mud'" (in Panter-Downes, 1967:7-8).[101]

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[99] Figures are taken from http://www.nilgiris.tn.gov.in/ [Accessed 16/01/10].
[100] These figures for rainy days are supported by Burton's observation; "The average fall of water is forty five inches in the year; there are nineteen days of heavy rain; of showers with fair intervals, eighty seven; cloudy twenty one, and two hundred and thirty eight perfectly fair and bright" (1851:249).
[101] This is an often-quoted statement and can be found in many of the texts that feature the history of the Nilgiris.

Figure 4.2 - Ootacamund, April 2007

Source: Photograph by author.

4.2 British Settlement

4.2.1 Foundation

Beginning his career as a writer in the Madras Establishment of the EIC, John Sullivan became the Collector of Coimbatore District in 1815,[102] a post which he held for the next fifteen years (Hockings, 1989b). It was in this capacity that Sullivan developed a fascination with the Nilgiri Hills, and became, as Hockings states, "…the Englishman destined to have a greater cultural impact on the Nilgiri Hills than any other single person, Indian or European, in their entire history" (1989b:334).

Although the Nilgiris had been ceded to the British in 1789, they remained relatively unexplored by Europeans until the early part of the nineteenth century.[103] It is this fact which prompted Tanna to echo Francis' (1908) statement in declaring, "Nilgiris may be said to be one of those happy districts which does not have to

[102] For the first thirty years of the nineteenth century, the Collectors of both Malabar and Coimbatore Districts assumed some authority over the Nilgiris, but by mid-century its orientation towards the market and administrative centre of Coimbatore was secure until 1868, when they were separated from the plains and placed under the office of a Commissioner (Sutton, 2009).
[103] Two centuries before the region's ultimate 'discovery' by the British, Europeans first explored the area around Ootacamund, "Looking for possible converts, the Portuguese sent a group of missionaries to the area as early as 1602" (Kenny, 1991:110).

suffer from a past" (1970:1). The European discovery of the Nilgiris is most often traced back to 1818, when two of Sullivan's assistants, a Mr. Whish and a Mr. Kindersley, found themselves on the hills during their mission to round up a gang of tobacco smugglers (see Kenny, 1991, Morrison, 2000, and Panter-Downes, 1967). When the pair returned, they are said to have fascinated Sullivan with their tales of the region's strange climate, fertile soils and abundant game. Sullivan's subsequent descriptions of the region directed the government to see the hills as a resource which should be claimed by the British, and in 1819 he and his supporters launched what was to become a seven year campaign to establish a military sanatorium or health giving retreat in the cool climate of Ootacamund (popularly known as Ooty) (Kenny, 1991).

> He erected the first house, which was built of stones, and the area is now familiarly known as the Stone House Hill. The site on which the stone house was built was purchased from the Todas[104] living in a Toda village called 'Wottakamund' and the settlement apparently took the name 'Ootacamund' from this association (Tanna, 1970:2-3).

Morrison (2000) provides an insightful account of the early dis-jointed and unrestricted building practices in the hills. In 1821 the first bridle path up to the hills was constructed. "The length of the path was 16¼ miles and the passage through this path was tedious on account of the innumerable ascents and descents" (Tanna, 1970:46). This was the chief route to the hills until the first Coonoor Ghat road was completed in 1832, becoming the main route from Madras to the Nilgiris (a journey which at the time took four days). Governor of Madras Mr. Stephen Lushington posted two sets of *palanquin* bearers all along the route whose services were available to Collectors. The construction of a new metalled road was completed from Mettupalayam to Coonoor in 1871. Construction of the Nilgiri railway began in 1891, and the section from Mettupalayam to Coonoor opened in 1899, the line later extended to Ootacamund (Tanna, 1870).

Ootacamund was in 1826, the first station to have a Post Office, and by 1855 several Post Offices had come into existence in the District. The first telegraph line was laid from Bangalore to Ootacamund in 1855 (Tanna, 1870). Work on St Stephen's Church (so named after the then Governor) began in 1830, and was consecrated at

[104] See section 4.2.2.

the end of that year (Francis, 1908).[105] "By 1829 the town's population had reached 500; and Sullivan then held five times as much Nilgiri land as did all other European inhabitants put together" (Hockings, 1989b:337). He prophesied that Ooty would become an England in the tropics, "a land where the European would increase and multiply, raise all manner of farm, dairy, and garden produce, and make much money there from – in fact, an Indian Utopia" (in Panter-Downes, 1967:134).

4.2.2 Nilgiri Hill Tribes

Once work began on the road into the hills, regular reports were made on the climate. One printed in the *Madras Government Gazette* stated that:

> In all other Hilly Countries the inhabitants usually bear evident traces in their persons of the unhealthy air they breathe, in their enlarged abdomens withered limbs and shrunk countenances. The people of the Neilgherries on the contrary are as healthy in appearance as people can be, and much more muscular, lively and active than the natives below... These facts all go strongly against the theory... (n.d. in Kenny, 1991:112-113).

These people (belonging to a number of distinct tribes) were to become a source of fascination for all future visitors to the Nilgiris, although as in many other imperial histories, usually received scant attention in published accounts. According to Burton, in 1851 there were five different races settled upon the Blue Mountains; the Bergers (the mass of the population, supposed to be about 10,000), the Erulars and Cooroombars (the wild men dwelling on the woody sides of the hills, about 2,000), the Kothurs or Kotas and the Todas (the old inhabitants and owners of the land, about 3,000).

John Sullivan was long remembered as the benefactor of the native peoples on the hills, particularly the Todas,[106] who were viewed as some kind of "elite barbarians" (Cederlorf, 2002:337), endorsing their absolute proprietary rights to the entire Nilgiri plateau (although this may well have also been to his own gain in attempting to retain the hills as, "practically his own private fiefdom" (Morrison,

[105] A new chancel was added in 1877 by Mrs W.G. McIvor in memory of her husband William, Superintendent of the Government cinchona plantations (Francis, 1908).
[106] Thought possibly to be descendents of the residents of Mesopotamia.

2000:17)). Some Todas still today strongly believe that Sullivan paid the Todas a golden coin for the land he took (Cederlorf, 2002).[107] "In 1828 it [the government] ordered that Todas must be paid for land at the rate of sixteen times the annual revenue assessment for the grazing of Toda buffalo. Yet by 1831 this arrangement had been conveniently forgotten, and the government got into the habit of granting 'waste land'[108] to British settlers without any compensation going to the Todas" (Hockings, 1989b:340). In 1835 Sullivan again campaigned on the Todas' behalf, and it was ordered that the government pay the Todas an annual sum of Rs 150 as compensation for the land in Ootacamund, a payment which continued until recent times. As Pradhan summarises in her story of the foundation of the hill stations, it is likely that, "in all these accounts of territorial acquisition, local resistance to the British takeover is inevitably underrated and demeaned" (2007:38).

Attention on the hill tribes has been biased in favour of the Todas owing to their distinctive healthy appearance, famous polyandry practices and intriguing religion built around the milking of buffaloes (Mandelbaum, 1989 and Emeneau, 1997). However their conceptualisation as 'noble savages' came to an abrupt end when it was discovered that in order to limit their tribes' numbers, the Todas practiced infanticide (Morrison, 2000), with female children either being drowned in milk or trampled by buffalo. This revelation made them a key target for European missionary efforts. Photography transformed images of Toda villages or 'munds' (figure 4.3 and 4.4), "...into an internationally recognised signifier of the Nilgiris and more specifically, the Nilgiris colonised by Europeans" (Sutton, 2003:83).[109] The groups' funeral rituals became another source of fascination for the European.[110]

[107] For more on the negotiation of Toda property rights on the Nilgiris see: Cederlorf, 2002 and Sutton, 2009 (particularly chapter 2), and on Toda 'munds' particularly see Sutton, 2003.
[108] See section 4.3.3 and Morrison, 2004.
[109] Clements Markham (leader of the British cinchona expedition), spent some of his time on the Nilgiris visiting Toda munds (see Markham, 1862a:389).
[110] This is the subject of chapter 7 of Sutton, 2009.

Figure 4.3 – 'Todamund' near Ootacamund by Samuel Bourne, *c.* 1865

Source: Falconer, 1984. Originally featured in Marshall, 1873 (see Sutton, 2009:169).

Figure 4.4 – 'Toda Mund and Todas, Ootacamund' by Stephen Ponsonby Peacocke (1847)

Source: http://gibberandsqueak.blogspot.com/2009/01/ooty-preserved-footnote-or-codicil.html [Accessed 16/01/10]. Originally published in Peacocke, 1847.

Figure 4.5 – Aboriginal Group, Nilgiri Hills (possibly Badagas), by A.T.W. Penn, 1870s

Source: Falconer, 1984.

In 1851 Burton reported that the population of the hill tribes was decreasing,[111] and although communities still remain on the Nilgiris, since independence in 1947, the traditional tribes have come into increasing contact and influence from the modern world and traditional practices are disappearing, cash crops for a national market forming the economic mainstay of the Nilgiris (Hockings, 1989c). Sutton attempts to summarise the impact of European settlement on the hill tribes.

> The occupation of the Nilgiris produced two conflicting, though often interwoven, approaches to colonisation. The Madras government sporadically took pains to point out in clear terms that the violation of indigenous occupation on the hills was unacceptable whilst simultaneously entertaining grandiose plans for settlement which made the physical displacement of the hill communities and the disruption of their economy inevitable (Sutton, 2003:81).

[111] This may well have been due to the importation of European diseases. Sutton, 2009:39–40 describes three disease epidemics that struck the hills and the Badagas particularly between 1851 and 1853.

For example, when fears were entertained that firewood for the European residents of Ootacamund was running low, "...the colonial authorities imposed restrictions upon the grazing of cattle by the Todas and the collection of grass and other forest produce by the Badagas" (Pradhan, 2007:51). Sharrad (2007) recognizes the part played by the tribal groups' resident to the Nilgiris in the preparation of the land for plantation agriculture (see section 4.3.3). Their nomadic agricultural practices, including the use of burning were paramount to the subsequent successful colonization of so many crops to the region. However by the end of the nineteenth century, neither the Todas nor any of the other hill tribes had a place in the historical narrative of colonisation (Sutton, 2009 and Price, 1908).

4.2.3 The Military Sanitaria

In the 1820s, when Sullivan was promoting the qualities of the Nilgiris, there was a desperate need for sanitaria within India, to house and rehabilitate those whose constitutions had been shattered as a result of exposure to the continual heat of the Indian climate.[112] After several years of campaigning, observation and measurement,[113] the mean heat at Ootacamund was established to be 63 degrees Fahrenheit (table 4.1), which was, as the Public Department declared in 1827, the very temperature "most favourable to the prolonged existence of man as an animal."[114] On this mounting evidence of healthiness, a convalescent depot was, after a lengthy campaign, duly constructed and reported as ready for the reception of European invalids (from both the Madras and Bombay Presidencies) on the 8th January 1830.[115]

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[112] As the President of Madras explained in 1827; "The great destruction of European health and life occasioned by the continual heat of the Indian climate is notorious; in every settlement in India it is continually depriving the public of the services of many valuable officers, civil and military, and blighting the prospects of many deserving persons. Hitherto there has been no place in India to which the invalid might look for recruiting his shattered constitution" (President's Minute, dated 6th December 1827. BPP, 1850:45).

[113] Sullivan himself "faithfully recorded meteorological observations five times each day," during his first four months of residence (Hockings, 1989b:341).

[114] Public Department, Minutes of Consultation, dated 11th December 1827. BPP, 1850:48.

[115] For a detailed account of this process see BPP, 1850.

Table 4.1 – Extremes of Temperature on the Nilgiris, 1820-21

TABLE showing the Extreme of Heat and Cold in the Shade on the *Neilgherry Mountains*, throughout the year 1820-21.

MONTHS.	Greatest Degree of Cold in the Hut at 6 o'clock, Morning.	Greatest Degree of Heat in the Hut at Noon.	Number of Days in each Month in which the Thermometer at Noon was under 70°.
March	53°	72½°	6 : no observation from the 1st to the 15th.
April	53	77	12.
May	57	79	13.
June	57	71	26.
July	53	72	26.
August	57	70	24.
September	57	77	25 : no observation for four days.
October	52	73½	26.
November	42	69	30.
December	44	71	26.
January	49	64½	18 : no observation for 13 days.
February	43	64	14 : no observation for the remainder.

N.B.—The number of days in which observations of the thermometer were made, was 311, and it stood below 70° at noon for 274 days. It may be remarked here, that the observations were taken at Jackainary, the first stage on the mountains. In the interior of the Hills it is many degrees cooler, and it is probable that for six or eight weeks, in the months of December, January and February, the thermometer will be found about the freezing point at dawn of day. In the Toduad District, on the 24th, 25th and 26th February last, I observed the thermometer at dawn of day to stand at 35°, 24½° and 29°.

Source: BPP, 1850:9.

Medical statistics from the depot soon supported the growing number of stories documenting the miraculous impact of the Nilgiri climate, showing many sick military men as 'recovered' having spent a sojourn[116] on the Nilgiris (table 4.2). During the first two years of operation, a total of 138 patients were admitted to the depot and of these, only 14 were found to be incurable on the Nilgiris. However, it was acknowledged that a stay on the Nilgiris was an unsuitable treatment for

[116] The average length of sojourn was 7 months. BPP, 1850:68.

hepatitis, rheumatism and bowel complaints - the principal diseases which European soldiers were invalided by.[117]

Table 4.2 – Numbers Admitted to the Convalescent Depot on the Nilgiris from its Establishment (January 1830) to the end of October 1832.

	ADMITTED:				DISCHARGED:					
—	In 1830.	In 1831.	In 1832.	Total Admitted.	Cured.	Improved, but not Cured.	As Incurable on the Neilgherries.	Total.	Died.	Remaining 1 Nov. 1832.
Of His Majesty's Service - - -	35	30	10	75	42	8	3	53	6	16
Of the Honourable Company's - -	18	30	15	63	33	3	11	47	4	12
Total - - -	53	60	25	138	75	11	14	100	10	28

Source: BPP, 1850:68.

Although recoveries continued to be observed, in 1835 the Governor of the Madras Presidency stopped funds for the mountain sanatorium at Ootacamund as medical reports for the previous two years had shown benefits, "far short of those anticipated... and that such as had accrued were in no way commensurate with the expenses incurred."[118] However this withdrawal of funding did not signal the end for Ootacamund, and the hill station continued to be a popular destination for both military men on sick leave, government officials (see below), and venture capitalists. An extensive military barracks was constructed at Jackatallah (later Wellington) between 1850 and 1852, following complex negotiations with indigenous groups over the rights to the land (Sutton, 2009).

During Richard Burton's visit to recuperate from cholera in August 1847, there were 104 officers on sick leave and the total number of Europeans in the Neilgherries was between five and six hundred (Burton, 1851). "The convalescents walked, rode, took afternoon naps, and went to bed early, as though in some

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[117] See BPP, 1850:67-68. In general, the degree of benefit awarded by the Nilgiris was supposed to be materially influenced by the age of the patient and the duration of residence in India, these factors taking precedence above the nature of the disease contracted.

[118] Extract Military Letter from Madras, dated 6th March 1835. BPP, 1850:113.

Britannic style spa, a Nilgiri Harrogate or Droitwich where the regime was strict" (Panter-Downes, 1967:109). Burton clearly describes the healthy appearance of the European population on the hills,

> There is a freshness in the complexion of the sanitarians that shows wonderfully to advantage when compared with the cadaverous waxy hue which the European epidermis loves to assume in the tropics. Most brilliant look the ladies: the gentlemen are sunburnt and robust: and the juveniles appear fresh and chubby, quite a different creation from the pallid, puny, meagre, sickly, irritable little wretches that do nothing but cry and perspire in the plains (1851:195).

With troops in mind, Surgeon Mackay saw the station as a place for 'seasoning': "The climate being a medium one, they [English troops having spent time at Ooty immediately upon their arrival in India] would be less plethoric than those just arrived from England, and their systems less exhausted and enervated than if they had passed any time on the plains" (Mackay, 1870:16). Mackay also saw the Nilgiris as being a beneficial place for those suffering from malaria,[119] explaining that,

> The atmosphere on the Neilgherries being more oceanic than that of the other mountain ranges usually resorted to...Such cases do well, when no important internal organ has become either structurally disease or functionally deranged to a serious extent. The patients generally gain strength rapidly, and the periodicity of the attacks being checked by quinine, they are soon restored to health (1870:23).

Word of the pleasant and healing climate soon spread to other sectors of the British population already in India, and to those back home who had hitherto been too scared of the consequences of tropical living to make the journey. Sickly civilians soon followed the military up into the hills, desperate to find an alternative to the long, costly and uncomfortable voyages back to Europe whilst plagued by infirmities. With medical significance granted to the vague illness that affected Europeans in India, holidaying (and governing – see below) in the hills became scientifically justified.

[119] Despite a recent increase in the risk of fever on the Western Ghauts, which he attributed to jungle clearance.

4.2.4 Dr Baikie's Observations on the Neilgherries

Walter Campbell, a spirited young highlander apparently described his ride up to Ooty in 1833 as passing out of the valley of death into Paradise (Panter-Downes, 1967). His and other early accounts were met with much scepticism as Burton recounted, "Such a climate within the tropics was considered so great an anomaly that few would believe in its existence" (1851:188). But as the numbers of visitors ascending the hills in the hope of restoring their health and deranged constitutions grew dramatically, Ooty's air and water came to be regarded as the finest in the world (Jervis, 1834).

In 1833, Mignan estimated the rapidly growing population of Ootacamund to be between three and four thousand, "The inhabitants, who have made the place a pandemonium, are an olla podrida of all nations. They are almost exclusively employed in providing for the souls and bodies of the English visitors..." (1833:122).[120] English visitors drawn up from the Madras and Bombay presidencies numbered somewhere between 120 and 140 (Baikie, 1834:6). By 1834 there were good bungalows[121] (resting places) and roads from Madras through Bangalore and Mysore to Ootacamund, and a range of Parsee shops had been established in the town, "where every European article may be obtained as cheap as at Madras" (Jervis, 1834:31), making life in Ooty increasingly comfortable, affordable and tempting for the Briton in India.

The most important commentator on the Nilgiris during the early years of British settlement was Dr. Robert Baikie (Superintending Medical Officer on the Nilgiris for three years in the early 1830s and also the first permanent Secretary of the Ootacamund Club (Francis, 1908)), who published his enthusiastic endorsement *Observations on the Neilgherries* in 1834 (figures 4.6 and 4.7), after observing around three hundred cases (Kenny, 1991), and taking meteorological observations for the previous three years.

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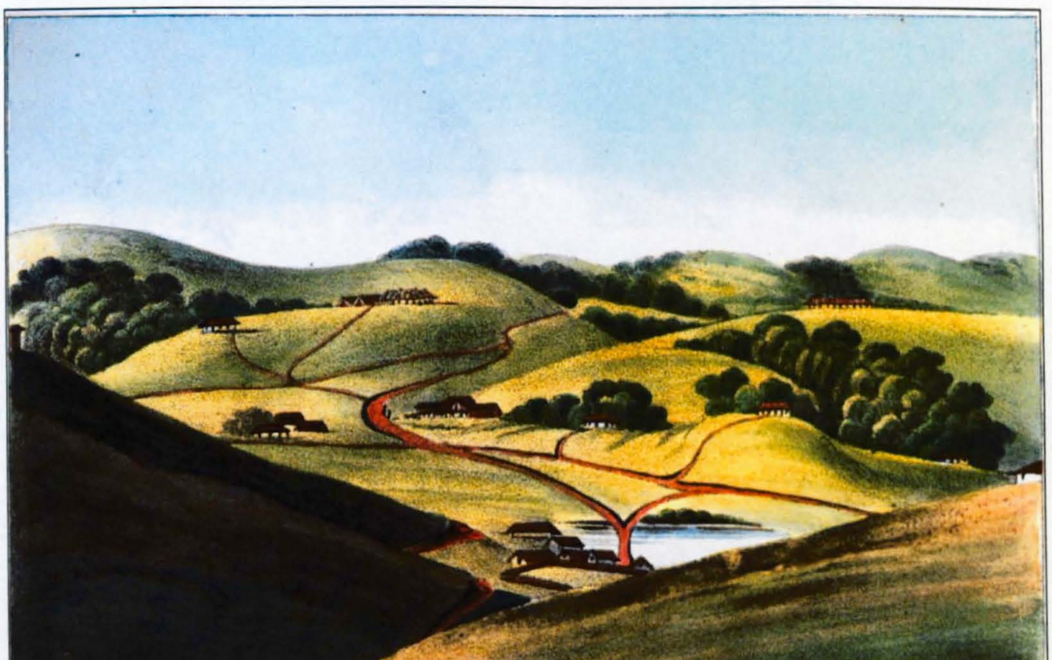
[120] Indian servants who accompanied British groups to the hills were numerous and essential, but were seemingly rendered invisible. These servants were often poorly prepared for the cool climate and institutions of the hills, but "the fact that these shivering servants did not do well in the highland climate served simply to reinforce the notion that this was a realm uniquely suited to the racial requirements of the British" (Kennedy, 1996:36).

[121] See King, 1995 for a history of the 'bungalow'.

500 copies of the first edition were executed,[122] in which he declared the hill climate to be similar to that of Great Britain, a development that proved essential propaganda in establishing Ootacamund's popularity. Another crucial element in forming the region's positive reputation was its location at high altitude, "No point on the hills, it will be observed, is less than 700 feet above fever range, (assuming the latter to be about 4,500 feet, the limit generally assigned), and most of them from 1,500 to 2,900 feet beyond it" (Baikie, 1834:12). Although swamps (a landscape feature associated with disease in Baikie's time), were a characteristic feature of the Nilgiri landscape, occurring in the valleys of the undulating land of the summit, in Baikie's professional medical opinion, "nothing like miasm or exhalation exists in or near these swamps; as a proof of which Todermunds or villages are frequently found in their immediate vicinity" (1834:13).[123]

Figure 4.6 - "Ootacamund – to the North of the Lake" by J. Bennett.



Source: Baikie, 1834: *frontispiece.*

[122] Five of them going to the Governor General Lord William Cavendish Bentinck (Baikie, 1834: *ix*).
[123] Recall that this medical topographical judgment that areas free of dense jungle vegetation and situated above the important 4,500 feet fever line would escape the impact of miasmas was in stark contrast to earlier thinking which had classed mountain air as inherently dangerous (Kenny, 1991).

Figure 4.7 - Plan of Ootacamund, 1834

Source: Baikie, 1834: foldout opposite p.6

Baikie judged that, as long as the constitution was prepared for it, the transition from the plains of Madras to the Nilgiris held a number of advantages:

> 1st. By exciting a healthy re-action in the system.
> 2nd. By exciting a new action, which overcomes the diseased one.
> 3rd. By restoring the healthy powers of the constitution, and the general tone of the viscera, particularly the digestive organs.
> 4th. By removing the eternally recurring causes of irritation in the low country, such as heat, moisture, closeness, &c.
> 5th. By breaking the habit of disease; a consideration of vast importance in some of the most obstinate forms of Indian disease (1834:53).

Evidence of this healthful climate could be found all around:

> If any proof indeed were wanted of the perfect adaptation of the climate to our constitution, it would be sufficient to look at the European children, whose rosy chubby cheeks, sparkling eyes, and buoyant spirits, form a pleasing contrast with the pale, languid, irritable-looking little wretches one is so often doomed to see dying by inches in the low country (Baikie, 1834:50).

The perceived healthful nature of the Nilgiris would remain a draw into the twentieth century as this quote from Playne's guide to South India from 1914 illustrates.

> ... It is not the scenery alone upon which the Nilgiris depend for their attractions; it is that health-giving climate... which restores to vigour and gives joy of living to those who are lacking in energy and vitality. When English tourists, wearied by the sameness of the old continental resorts, thoroughly understand that within about fifteen days from Home they can obtain the unexampled benefits of the Nilgiris, it is practically certain that they will yield to the hills that just recognition of their unique merits which they so richly deserve (Playne, 1914–15:233).

After finding fame as a healthy retreat, the Nilgiris soon also became an important centre in the political geography of the Indian Empire, and part of the apparatus of control of European administration of India and other tropical colonial territories.

4.2.5 Governing from the Hills

In 1827 Lord William Amherst, then Governor General, set the precedent for vacationing in the hills, but in Darjeeling, not Ootacamund (Hockings, 1989b).[124] The first Governor of Madras to visit Ootacamund was Sir Thomas Munro in September 1826 (Pradhan, 2007), and from then on, Ootacamund developed a strong association with senior government officials. "From the time of Sir Thomas Munro, down to that of Lord Napier and Ettrick in whose rein the 'annual exodus' commenced, only two of the rulers of Madras failed to visit the Nilgiris" (Price, 2006:72).[125] By 1834 even the Governor-General Lord William Cavendish Bentinck, the highest official in British India, spent several months a year in the Nilgiris (Mandelbaum, 1989). However in reality Bentinck saw his stay[126] as more necessity than holiday. After being advised by his Doctor[127] to remain at Ootacamund for several months longer than first anticipated he wrote home to his brother;

> This is a great disappointment, but I believe it to be necessary – and he [the Doctor] promises...for being away from my home and my house up in the dullest imaginable place, that I may hope to return to England with an unimpaired constitution – that is in respect to climate and age. He is candid on this point.[128]

The practice of relocating the Madras government to the Nilgiri hills began in the hot weather of 1864, the main argument in favour of the move being that Europeans would be able to complete more work in a shorter time than in the hot plains (Kenny, 1997). London rejected several requests from the government of Madras during the 1860s to transfer its council to Ootacamund for the summer months, but Madras continued to press for the move and in 1870 an official three month stay was granted. After 1870, the Madras government was transferred to Ootacamund from April to October every year (Kenny, 1997). "Getting away from the scorching plains was seen as medically necessary", and the annual exodus became something of a spectacle as numbers of participants and length of stay

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[124] See chapter 2 for more on the development of hill stations.
[125] These exceptions were Sir Henry Pottinger (April 7th, 1848 – April 28th, 1854), thought to have never left the immediate neighbourhood of Madras, and Sir Henry Ward (July 5th – August 2nd, 1860), who died of cholera a month after assuming office (Price, 1908).
[126] He is said to have stayed at the large house that was to become the Ootacamund Club (Pradhan, 2007).
[127] It would seem natural to presume that his Doctor would have been Dr. Baikie.
[128] Letter dated Ootacamund, May 13th 1834. MSCN. PwH303. Also see PwH302.

increased, "... the journey to the hills itself became an event, and a process through which the grandeur of the Empire was underlined" (Pradhan, 2007:53).[129] Writing in 1877, the editor of the *SIO* referred to Ootacamund as the "invigorating heart of the Presidency" (in Kenny, 1997:664).

Construction of Government House was begun in 1877 and the building first occupied in 1879 (Francis, 1908). The shift of political authority to the hills has been seen as a development, "...in direct conflict with the idea of the picturesque that strongly appealed to the early travellers" (Pradhan, 2007:52). What came to be seen as a 'natural' arrangement never lacked its critics, and after the 1870s, Indians began to organise protests, taking the view that, "The hills are the curse of modern India. They are the most fertile cause of the increasing alienation between the rulers and the ruled which menaces the safety of the Empire" (*The Madras Mail*, April 14th, 1884 in Kenny, 1997:656).

Western educated Indians increasingly organised themselves and began to show a new awareness of government and its practices. Organised opposition was particularly impressive in the case of the Madrassi Petition to Parliament against governing from the hills in 1884.[130] At this time many looked back and quoted the words of Thomas Munro, Governor of the Madras Presidency between 1820 and 1824; "... the 'loss of touch' is an evil besides which the subjection of august personages to a high temperature, mosquitoes, and prickly heat dwindles into insignificance" (reproduced in *The Madras Mail*, July 18th 1884 in Kenny, 1997:660). There is also evidence of rising tensions between the Nilgiri's European residents and visitors (who were usually of a higher social status), "It was quite reasonably pointed out that virtually the entire tax burden was borne by local residents, whilst visitors, in particular the huge apparatus of the Madras government, represented the greatest demand on the infrastructure of the hill station, straining the Ootacamund municipality's limited resources" (Morrison, 2004:70).

The Nilgiris themselves were under the political leadership of the Collector of Coimbatore until 1868, when they were separated from Coimbatore and James

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[129] As Morrison, 2000 points out, this process was particularly dependent on Indian labour and enterprise.
[130] See Anon, 1884.

Wilkinson Breeks took over the administration of the Nilgiris as its Commissioner. In February 1882, the Nilgiris was made a District and a Collector was appointed in the place of the Commissioner, Richard Wellesley Barlow, the then Commissioner becoming the first Collector of the Nilgiris.[131]

By the 1930s, most provincial governments had entirely given up their annual migration to the hills and the hill schools had been opened to Indians. In the period prior to independence increasing numbers of guidebooks written by and for Indians, advertised the therapeutic benefits of the hill resorts, as Spencer and Thomas proclaimed in 1948, "Today… many well to do native residents of every country in the Orient, except possibly Siam and Indochina, visit the white man's mountain resorts and fully appreciate their virtues" (1948:648-649). According to the inquiries made by Mollie Panter-Downes' for her book *Ooty Preserved*, there were around thirty European families still living in Ooty in 1966.

This study is focused on the period 1860-1900, a time when Ooty's population was increasing rapidly, as news of its salubrious climate spread, and as government officials took up residence in the hills with increasing frequency. As resident and visitor numbers expanded, frequent comparisons were made between the Nilgiris and home (Britain), and with well known stops on the tourist trail (including Australia, South America, the Mediterranean, Switzerland, Egypt and others). These perceived climatic similarities resulted in the belief that the Nilgiri environment was not only thought to aid the acclimatization of Europeans to India, but also to be conducive to the establishment of plantation crops including tea, coffee, cinchona, eucalyptus and rubber, smaller scale garden productions, and a wide array of animal life including salmon, and fox hounds.

4.3 Horticulture and Acclimatization

4.3.1 English Gardens

John Sullivan (founder of the British settlement at Ootacamund) had ambitious visions for the Nilgiri landscape, and one of his first actions was to create a large lake which became known as the Nilgiri Windermere (figure 4.8). His original

[131] See http://www.nilgiris.tn.gov.in/ [Accessed 16/01/10].

intention was to develop the lake into an irrigation system but this never came to be. Turning more directly to the agricultural capacities of the hills,

> Mr. Sullivan applied to the Government for permission to enclose 1900 acres of land, which lay idle and fallow, to enable him to make experiments in agriculture and horticulture. In making the application to the Government he said: 'The experiments may eventually prove useful to the Public, and the expenses of making them will be my own' (Tanna, 1970:3).

It was perhaps Sullivan's over-ambitious nature which attracted criticism,[132]

> One of his most resented feats was to enclose two hundred acres of excellent land on which he said he was going to make agricultural experiments – only somehow the experiments did not come off. He was genuinely interested in agriculture, however. He started plantations of flax and hemp and he imported barley... Hops were tried, but they were one of the few crops that did not take to the Nilgiris (Panter-Downes, 1967:30).

For Sullivan then, colonisation of the region became a method of 'improving' the Nilgiris through their agricultural capacity. As early as 1821, Sullivan's passion for gardening had led him to send for a gardener from England, a Mr. Johnston, who arrived at Ootacamund accompanied by English apple and peach trees, and strawberries, and who had been "especially engaged by Sullivan to manage an experimental garden and farm which he had established next to Stonehouse for the purpose of growing European vegetables" (Morrison, 2000:11). Together they introduced numerous garden productions to the hills (new varieties of oats, wheat and barley; market crops of beetroot, turnip, radish, cabbage, potato, strawberry, peach and apple; ornamental flowers including laburnum, rose, heliotrope, violet and others including oak, hemp, flax, vetch, lucerne and geranium), a list which according to Hockings is, "especially remarkable because all of these items are still grown in the district" (1989b:338). In 1828, around 130 acres of land was appropriated from the Badagas community at Keti for the establishment of a Government run farm for the cultivation of European crops and trees (Sutton, 2009).[133] Neighbours were soon competing with each other in their vegetable gardens. "A beet is recorded as being nearly three feet round, a radish three feet

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[132] For more on Sullivan's critics see Morrison, 2000.

[133] The Badagas protested continually during the five years the farm was in operation. After the experiment had been declared a failure, lengthy negotiations took place, but ended with the government retaining the land and farm buildings (Sutton, 2009).

long, and a cabbage plant eight feet high" (Panter-Downes, 1967:31). All of the European residencies had gardens (Nicholl, 1888), which acted to domesticate the landscape offering the opportunity to recreate little pieces of home (Aiken, 1987).

Figure 4.8 - 'View from the Lake' by Richard Barron, c. 1837

Source: http://gibberandsqueak.blogspot.com/ [Accessed 16/01/10].

Mignan recognised the rich potential productivity during his tour of the region in 1833:

> Vegetables here are very fine, and in great abundance,- a striking difference, and a convincing proof of the superiority of the soil and climate to that of the plain below, where neither corn nor vegetables will ever attain to great perfection…Here potatoes ripen, and cauliflowers come to a head. Also turnips, radishes, beet-roots, onions, leeks, peas, beans of all kinds, carrots, parsnips, cabbages, lettuces, artichokes, pumpkins, &c, thrive amazingly (1834:82-3).

The hill climate appeared to instigate growth of almost magical proportions in some vegetable species; "Plants of the fern tribe, which in our own country grow close along the ground, shoot up here to the dimensions of trees" (Mignan, 1834:110). Vegetable gardens were kept chiefly by Badagas and immigrant Canarese gardeners (Nicholl, 1888, Playne, 1914-15), and their produce sold at the Tuesday market.

Describing the ascent to Ootacamund in 1914 Fyson states,

> On all sides he [the traveler] now finds reminders of familiar plants of Europe and North America; at first few, then as he passes across to the higher parts near Ootacamund, at 7,000ft., more and more numerous, until he feels he is again in a country possessed of temperate climate. Here grow many of the familiar field and wayside flowers of England: Rose, Bramble, Clematis, Barberry, St John's Wort, Gentian, Violet, Buttercup, Orchids, and many others; not of the same species, certainly, but obviously nearly all allied, and of the same genus (1914–15:95).

The planting of English oaks and firs completed the curious illusion of England in India, nostalgia the common experience for Britons in the hills. As Playne commented in his guide of 1914-15, "...It would be no stretch of imagination to fancy that the country lanes of Surrey and Kent had been transferred from England to India" (1914-15:233). The presence of private gardens and the enthusiasm for all things horticultural demonstrated by the settlement's residents were influential in the foundation of a government run botanical garden at Ootacamund in 1848.

4.3.2 The Government Botanical Garden

Previously contained to the individual household, in the 1850s Nilgiri gardens expanded in size and ambition. The Horticultural Gardens (later the Government Gardens) were established in 1848 on a 54 acre site on the slopes of Dodabetta peak, which, since 1845, had been run as a vegetable garden where subscribers paid Rs. 3 per month, and in return received their vegetables free of charge. This arrangement did not prove remunerative (Price, 1908) and in early 1847, a fund was raised with a view to forming a Horticultural Society and starting a Public Garden. The prospectus issued in 1847 to propose its formation emphasized the contribution that such a garden would make to acclimatization experiments involving both British and Indian produce.

> There can be but little doubt that the establishment of such a garden will afford much satisfaction to men of science and amateurs in Great Britain, and with the extensive knowledge which many a gentleman residing on the Hills possesses, vegetable, floral, and arboreal productions of India will lead to communications attended with mutual advantage, thus rendering a public garden under judicious management of far more extensive usefulness than can at present be forseen (reproduced in Price, 2006:240).

In reply, the Court of Directors sent out Mr. William Graham McIvor in March 1848 from the Royal Botanic Garden at Kew whose job it was to transform the 'dense jungle' into picturesque gardens (Anon, 1848:20).

McIvor saw 1852 as the year of real progress for the gardens, explaining in the annual report that,

> The gardens have this season arrived at that period where we have got abundant material to work upon, as we never received more than two plants of any variety of fruit tree from England, and these generally so much weakened by the long voyage and heat they made little or no wood fit for budding or grafting the first season, so that this is the first year in which we have been able to propagate fruit trees on a comparatively large scale.[134]

It is thus clear that efforts were focused on the task of making 'English gardens in India' (see Roberts, 1998 and Plotz, 2007). Now the foundations were in place, it was decided the whole of the plants propagated (with a few exceptions) would be for public sale. Keen to emphasise the role the Government Garden could play in both the European and Indian communities of the Nilgiri Hills as a provider of high quality fruits, vegetables, trees and grains, McIvor hoped that he would soon, "...be able to offer to the Indian community seeds at a very low price and of as good quality as can be produced in any part of the world..."[135] A second, smaller garden had also now been established at Kulhutty (at an elevation of 4,500 feet), to act as an 'intermediate nursery' for preparing plants for the transfer to the warmer climate of the plains as well as for introducing those fruits too tender to encounter the Ootacamund climate directly.[136]

By 1855 McIvor was of the opinion that the garden at Ooty had already achieved great things and was playing an important part in the activities of the British Empire, especially in the contribution made to the production of vegetables for European soldiers. He was keen to educate the residents of the hills in all matters horticultural, and circulated notes on the cultivation of fruit trees with a number of the annual garden reports. Knowledge was viewed by McIvor as being very much the key to successful acclimatization, as he explained in the report for 1855-56;

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[134] BL. RHBGO, 1851-1852:2.
[135] *Ibid.* p.3.
[136] *Ibid.* p.4.

> In all improvements, capital is not so much the agent of success, as practical and scientific knowledge, and this latter is much needed in the cultivation of the present produce of the country, how much more necessary it then becomes, in dealing with exotics. In my humble opinion the want of a better knowledge of Horticulture is the cause of three-fourths of the valuable plants supplied with profit to these gardens, being a dead loss to the public, and a total failure as regards future benefit to the country.[137]

In the same report he outlined the rewards to be reaped from apprenticing schemes, speaking of the need for a School of Horticultural and Agricultural education and of devoting some space within the Government Garden to a library, herbarium and museum of vegetable productions. In 1855, he revealed his grand ambitions for acclimatization at Ootacamund to T. Clarke, the Collector of neighbouring Malabar,

> Next in importance to the discovery and application of indigenous productions is the improvement of the resources of the country by the introduction of various useful trees, shrubs, herbs, &c., such as are indigenous to other countries similarly situated. The success with which this has been done in other countries argues for success in India also. For instance, sugar, coffee, cotton, ginger, pepper, cloves, maize, lemons and plantains were introduced to the West Indies;- rice, cotton, &c. to America. The vine to the Cape. Hence the produce of plants introduced to these countries, now form the principal source of their own wealth, staple products and exports.[138]

McIvor had already compiled a list of plants he deemed worthy of introducing to India. Included among them was, "Cinchona Micrantha, and other species of Cinchona which produces the Peruvian bark from the hills in Peru where it grows at elevations from 3,000 to 5,000 feet."[139] Markham later emphasized McIvor's longstanding interest in bringing cinchona to India, "...he brought the subject to the notice of Lord Harris, then Governor of Madras, as long ago as 1855. Since that time he has made himself master of the subject by a study of every work of any importance which has appeared in Europe within the last thirty years" (1862a:484). Building of the garden's first conservatory began in 1856 (at a cost of 4,300 rupees), in consequence of the Governor General remarking that the existing glasshouse for raising young plants was, "little larger or better than a cucumber frame" (in Price,

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[137] BL. RHBGO, 1854–1855:13-14.
[138] *Ibid.* p.17.
[139] *Ibid.* p.19. Cinchona was frequently mentioned in these early reports, and first arrived on the Nilgiris in 1856 (see chapter 5).

2006:245). An interchange of plants and seeds between the Calcutta, Madras and Ootacamund gardens was officially put into practice the same year, and by 1860 the network had extended dramatically:

> An active interchange of seeds and when possible of living plants, is kept up with kindred institutions in Ceylon, Calcutta, Mauritius and Melbourne. It is specially desirable to reciprocate with the Government Gardens at the two places last named, as the productions of New South Wales appear to suit the Neilgherry Hills in a remarkable manner. We are likewise endeavouring to establish a system of exchange with persons at Hongkong and Saint George's Sound.[140]

Together, the gardens in this global network were conducting groundbreaking work in acclimatization, and even greater things were predicted as transport technology improved. The risks involved in the transportation of plants became starkly apparent in the garden report for 1859-1860;

> I regret much to state that the whole of our consignment of plants and seeds from Home have this year been entirely lost. The boxes having been swamped in the Sea at Madras, and as they were not then unpacked and the contents dried, but despatched in a damp state, fermentation immediately took place, and on reaching Ootacamund, the whole were found to be quite destroyed.[141]

Even when plants arrived safely, numerous difficulties and obstacles to success remained. Dr. Wight (commenting on McIvor's 1852 report) explained how the very habits of the plants must be changed;

> February, March, April and May being bright warm months well fitted for maturing fruit are to the fruit grower on the hills, what the months of June, July, August and September are to the horticulturalist in England. In this difference of the seasons lies the great difficulty of cultivating European fruits on the hills. The habit of the trees must be changed so as to induce spring-flowering trees to flower in autumn and ripen their fruit in Spring.[142]

Usefulness and functionality were important attributes of the majority of plants gathered at the Ootacamund Government Garden, and in 1860 Cleghorn[143]

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[140] BL. RHBGO, 1859-1860, comments by Cleghorn, p.1.
[141] BL. RHBGO, 1859-60:3-4.
[142] BL. RHBGO, 1851-1852, comments by Wight, p.4. For more on Wight see Noltie, 2005, 2007.
[143] Cleghorn was now Conservator of Forests in the Madras Presidency.

reported to government that, "Particular attention is paid to plants used for food or articles of medicine, or likely to become of commercial value."[144] Medicinal plants had been an area of focus from the outset, with the gardens supplying the Medical Stores with henbane and foxglove by 1855.[145] However, McIvor thought that cultivating medicinal plants on a large scale[146] would be a step which would exceed the capabilities of the Government Gardens, "In the first place, their cultivation for anything more than experiment would require more land than we can possibly allow in the gardens; the preparation of some of the sorts being attended with considerable difficulty, could not well be done in this establishment."[147]

Private efforts in acclimatization continued alongside the grander schemes of the Government Gardens. As Cleghorn commented, the early residents of the Hills "... introduced many varieties of fruit and other trees under greater difficulties than are present encountered. Steam communication and Wardian cases not having then been available."[148] McIvor however disputed the nature of the early progress by amateurs,

> The late Mr. Casamajor and General Kennet being noted for their interest in the welfare and prosperity of these Mountains, spent large sums in their endeavours to introduce European fruits, and their united efforts, extending over a period of 15 years, has been to secure to the country two varieties of apple only. With these exceptions they invariably arrived in a dead or dying state.[149]

The Government Garden went on to play important roles in the development of plantation crops, and also became something of a pleasure park, central to community recreation (Kennedy, 1996). We now step up in scale from the garden to the estate or plantation, where the acclimatization experiments would be proved success or failure.

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[144] BL. RHBGO, 1859-1869, comments by Cleghorn, p.1.
[145] See BL. RHBGO, 1853-1855, comments by Cleghorn, p.1.
[146] With the exception of digitalis from the foxglove.
[147] BL. RHBGO, 1858-1859:11.
[148] BL. RHBGO, 1857-1858, comments by Cleghorn, p.6.
[149] BL. RHBGO, 1857-1858:22.

4.3.3 Plantations

In the nineteenth century, the Nilgiri District became one of India's most important planting regions, a development which was accompanied by rapid population growth (Folke, 1966). The agricultural potential of the hills struck many of the Nilgiri's early visitors and residents, sparking ambitions for larger scale experiments in acclimatization. Medical Officer Robert Baikie concluded that,

> Coffee would undoubtedly grow on the slopes of the lower vallies, and Baron Hugel found in considerable abundance near Coonoor the Camellia Japonica, which is said to affect the same soil, climate, and exposure, as some of the more valuable descriptions of the tea plant, from which and other circumstances, he inferred that the latter might be cultivated with advantage... (1834:37-38).

Those pioneer planters who decided to open up tracts of jungle to begin plantations were faced with a plethora of hardships.

> It was almost inaccessible hill tracts, dense jungles and malaria-infested marshes that the early planters cleared... They rode on horse or sat up in bullock carts or were carried in a variety of slung chairs along the rude tracks of the plains that passed for roads and then took to foot to climb the peaks. They followed the elephant trails, and made the first clearings of forests infested with elephant and bison, tiger and leopard, wild boar and wild dog, built grass huts to live in and shot the sambhur (or elk) and boar, wild pigeon and jungle fowl and a variety of small game to live on, brought in labour from the plains and tried to keep them from running away from the cold and an atmosphere of almost palpable fear all around, planted the first nurseries and raised the first crops as they went on to clear another block or two (Muthiah, 1993:13).[150]

Beginning his life as a planter in 1856 Robert Henry Elliot explains,

> The southern part of Mysore was thus occupied by four planters, and we were all about twelve miles from each other. It is difficult to conceive the state of isolation in which we lived, as we were all European speaking single handed, and could seldom leave home, we often had not for weeks together an opportunity of seeing a single white face...But we had plenty of work, and big game shooting, and the occupation was an interesting one... (1894:4–5).

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[150] Also see Behal, 2010:33-35.

Although planters became part of the 'upper-middle' class on the hills (alongside lower officials, the retired, chaplains and army officers, see Hockings, 1989b),[151] in many cases the planter's life continued to be a lonely and dangerous one, as they were forced to contend with inclement tropical weather, wild beasts, and disease.[152] Although most came from respectable enough class backgrounds in England, "the nature of their work and their involvement in a commercial enterprise placed them in a position inferior in power and prestige to the officials and officers" (Mandelbaum, 1989:12). Hockings describes some of the strategies employed by the planters to combat their isolation:

> Some of the planters 'went native' and formed families of Anglo-Kurumbas, for example, or indulged themselves in similar liaisons of a more temporary nature with selected tea-pluckers [a consequence perhaps of the] ... permanent shortage of marriageable English ladies in the Nilgiris (Hockings, 1989b:352-353).

The Nilgiri planters, on the whole, came to the region as settlers, to stay for a prolonged period.[153] Morrison (2004) illustrates this point using a quote from Secretary Schmidt's Ootacamund municipality address to the Viceroy Lord Lytton in 1877:

> In most other parts of India, as your Lordship is aware, the Englishman is simply a sojourner. He leaves his native land to fulfil an official or commercial career, and then returns to his home. On these Hills, however, we find Englishmen devoting their capital, their energies, and their lives to the permanent development of the resources of the country. They have made the Nilgiris their home (reproduced in Morrison, 2004:57).

Yet surprisingly the planters held virtually no political rights. In the early part of the nineteenth century in the Madras Presidency, government wasteland[154] could usually simply be taken up for cultivation upon an application to the Collector, but the Wasteland Rules drawn up for Hill Country in 1859 by Sir Charles Trevelyan, Governor of Madras, which came into force in 1863 "...were the Nilgiri planters'

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[151] A large number of the European planters on the hills were themselves retired military officers or civil officials (Morrison, 2004).

[152] For more on the management of the tropical environment see chapter 7.

[153] This is in stark contrast to the planter culture in Dutch Indonesia, certainly according to Goss's account: "As a class they were primarily interested in improving their individual fortunes, not on settling permanently. They were similarly uninterested in science, even agricultural science" (2004:87).

[154] The term given to all unoccupied land.

principal bugbear throughout the nineteenth century" (Morrison, 2004:58).[155] The rules stated that all wasteland had to be sold at auction to the highest bidder,[156] and those who lodged the applications often lost out, not infrequently to speculative Indian businessmen (Morrison, 2004), who rose in prominence on the plantations as the century progressed.

> Indian entrepreneurs were a very significant presence in planting, controlling almost half the total acreage of 245,000 by 1902...Most Indian estates were very small, however, and commercially were less significant than large European ones...However Gool Mohamed Sait and Pestonjee Nusserwanjee, the heads of what were respectively the richest Gujarati and Parsee families in Ootacamund, also diversified into coffee-planting in the 1880s, where the capital they had accumulated in the retail trade enabled them to purchase some very large estates (Morrison, 2004:66).

The principle problem was the lack of information regarding land ownership held by the government, who hoped that the auction procedure (in which each hopeful settler had to pay for his own survey and demarcation of his favoured parcel of land) would "...give the revenue authorities a firm grasp of the geography of colonisation, if not indigenous occupation" (Sutton, 2009:53).[157] Captain James Ouchterlony's survey of the Nilgiris begun in 1844, had been commissioned as Sutton explains, "to create limits around the nebulous agrarian landscape of the indigenous communities, not so much to define that landscape than to demarcate what lay outside of it: wasteland, the absolute and disposable property of government" (2009:55), but his resulting map and associated manual failed to create a definitive wasteland map, and thus, "the plans acquired during auction procedure became the sole means of creating cartographic abstractions of properties on the hills" (Sutton, 2009:56).[158] This method continued until 1878, when a new survey was undertaken. "The land-tenure history of each estate [248 in number] was

[155] Morrison (2004) sets the wasteland rules within a wider hostility of the Government of India to permanent European settlement on the Nilgiris.
[156] The maximum size of a lot was 500 acres (McPherson, 1870).
[157] In general, members of the indigenous hill tribes also had to follow the Wasteland Rules if they wished to extend their holdings. However the more numerous Badagas were allowed to freely take up lands until the 1880s, avoiding the auction process imposed on Europeans.
[158] Planters could however get round the restrictions imposed by the Wasteland Rules by purchasing land directly from those who claimed indigenous rights to it. There is some evidence that this practice led to heightened tensions between indigenous hill tribes (Sutton, 2009:87).

garnered from its owners, and its limits, along with those of forests and grazing, were fixed and mapped" (Sutton, 2009:75).[159]

Planters who persevered with the auction process were granted some allowances. Purchasers had the option to pay for their land in three yearly installments (at an interest rate of 6%), and all land sold through this method was, "free from all demand on the part of the State on account of land revenue" (Tanna, 1970:18).

Timber plantations were among the first to occupy residents of the Nilgiris.[160] "The demand for wood as fuel created by the establishment of settlements was enormous. By 1859, an estimated four thousand fires burned every day on the hills, at least one thousand of those in the hearths of newly settled Europeans" (Sutton, 2009:115). The native woodlands or *sholas* were deforested at an alarming rate, and desiccation arguments were used as early as 1838 to frame the forest clearance in environmentalist terms. However, the naturally forested areas occupied the land most desired for the establishment of coffee, tea and cinchona plantations, and although officially planters were required to obtain permission from the Collectorate before felling timber, in practice many planters totally cleared the forests on their newly acquired land (Sutton, 2009).[161]

Australian eucalyptus or blue-gums were introduced around 1832, Captain Morgan[162] developing the first plantations at his Tudor Hall estate in 1853 (Sharrad, 2007:36). A large experimental plantation of quick growing Australian acacias was established in 1856 at near the military barracks at Jackatallah by Captain John A. Campbell the officer in charge, after he'd estimated the likely fuelwood demand from the barracks and nearby Coonoor over the next five years. By 1857 he had planted out 14,400 *Acacia robusta,* "in long lines of mathematical accuracy, so that not one can be cut without immediate detection" (in Sutton,

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[159] It seems logical to assume that the comprehensive list of plantations given as an appendix in Anon (1877) used the preliminary results of this survey.

[160] See Sutton, 2009, chapter 5, for more on fuelwood debates and the conservancy of forests on the hills. Officially the sholas occupying the highest land (above 4,500 feet) were subject to the most restrictions, but in practice planters often found ways to get round these rules. Also see Cleghorn, 1861:158-163.

[161] Sutton, 2009:119-120, uses the case of John McIvor (brother of William, Superintendent of the Government Cinchona Plantations) to illustrate this point.

[162] Morgan later became involved in the cinchona industry.

2009).[163] Campbell's plantation ultimately failed, and as Sutton explains, "Was received as conclusive proof that plantations would have to be established on cleared *shola* land and not on grassland" (2009:132).

A government plantation of Australian trees was commenced in the year 1858, and involved the planting of about 10,000 trees in the vicinity of Ootacamund, including blue-gums, wattles, conifers, pines, and cypresses (Playne, 1914-15). Repeated attempts were made to distribute eucalyptus seeds and plants to the hill tribespeople (Sutton, 2009). Early reviews of the eucalyptus' progress can only be described as conflicting. The joint magistrate at Ootacamund, Colonel Babington, wrote to the Collector in 1854, "You have amply tried the extension of Australian trees here, but have found it impossible to clothe the hills with them to any extent, from their early delicacy, their being stolen, and their shape, which is not adapted to affecting climate by foliage as are commoner forest trees" (in Price, 2006:252-253). Yet only two years earlier McIvor had declared that, "...Australian plants of all kinds thrive particularly well here, which is a mark of the similitude of this climate and soil to that of Australia."[164]

Although many came to believe that the eucalyptus took to Ootacamund all too well, becoming the main source of fuel at Ootacamund, and a dominant feature of the landscape (Price, 1908), the restrictive influence of the Nilgiri climate upon their growth was recognised. When eucalyptus trees were measured in 1882 by the Forest Department, the results showed "...that the trees had, in 1882, apparently attained nearly the full growth that they will reach in this climate, which is however a mere nothing compared with the size which the eucalyptus, a variety of which is the largest tree in the world, attains in its native land" (Price, 2006:250).

According to several authors the first coffee estate in the Nilgiris was established in 1838 near Coonoor by Mr. Dawson (Folke, 1966, Tanna, 1970). Colonel James

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[163] Sutton 2009 includes an illustration of Campbell's plans for the new forest at Jackatallah (p.127). Campbell also attempted to replant and cultivate native shola species in the area adjoining his new plantation.
[164] BL. RHBGO, 1851-1852:2. The identification of climates similar to that on the Nilgiris was an activity to which much time and thought was devoted. Evidence in favour of the suitability of the Nilgiri climate for a range of South American plants was a key factor in its selection as the site for the British Cinchona experiment (see chapter 5).

Ouchterlony[165] had been quick to document the region's potential for plantation agriculture owing to its proximity to the neighbouring provinces of Malabar, Mysore and Coimbatore which could supply coolies in sufficient numbers to meet all demands, and at all seasons of the year (Ouchterlony, 1847, in Shortt, 1868:28), and opened the first coffee estate 'Lauriston' in the Nilgiri-Wynaad[166] in 1842 (Muthiah, 1993:15), the area then becoming known as the 'Ouchterlony Valley'. The famous 'Ouchterlony Valley Estates' were opened in 1850.[167]

Previously part of Malabar, the Ouchterlony Valley was added to the Nilgiri District in 1873 and the Southeast Wynaad (plateau) in 1877. It would be when cultivation was extended to the inland portion of this District, that the Nilgiri-Wynaad region "proved its true worth as a planting centre" (Davis, 1920:42). The 'Wynaad' is described by Muthiah, as "the three outlying tracts of the Nilgiris: a strip of malarial jungle skirting the northern foot of the plateau, a deep recess in the high wall of the plateau [Ouchterlony Valley]... and, further west, a tableland of bamboo forest and swamp at a height of about 3000 feet" (1993:30).

Coffee expanded rapidly, but was checked after the appearance of the coffee leaf disease *Hemileia vastatrix*, eighteen months after it first appeared in Ceylon in 1869 (Muthiah, 1993). However the South Indian estates faired better than their Ceylon counterparts and in the 1870s coffee expanded, reaching around 25,000 acres by 1879 (Francis, 1908). At this peak, the harvested crop amounted to around 4,500 tons (Tanna, 1970). Entering the 1880s, coffee suffered a dramatic decline as a result of recession, the cinchona boom following the soaring price of quinine (a number of coffee estates converting to cinchona), and the discovery of gold in the Nilgiri-Wynaad (Folke, 1966:207).

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[165] Of survey fame, see above. Ouchterlony was one of the region's most famous 'pioneer planters', a long-term resident of the hills who also owned *The Spectator* newspaper in Madras (Muthiah, 1993).
[166] A lower lying area in Gudalur taluk. The region's dangerous association with malaria is evident in its name the Wynaad – Vayalnaadu – "the land of swamps" (Muthiah, 1993:30).
[167] For more on the early or 'pioneer' planters see Muthiah, 1993, chapter 2 and chapter 3. For more on the 'Ouchterlony Valley' estates, many of which remained in the ownership of the Ouchterlony family into the twentieth century, see Playne, 1914–15:258-263.

> ...the cinchona boom of the late seventies played the final scene in completing the ruin of the coffee estates. Quinine was then selling in London at twelve shillings per ounce, and planters rushed headlong into the cultivation of cinchona. Those who made large nurseries reaped small fortunes by the sale of plants... But the boom was of short duration (Wilkes in Muthiah, 1993:32-33).

Although not a plantation crop, prospecting for gold involved large portions of Nilgiri plantation land. Surveys began in 1874, and in 1879 a report anticipated a lucrative development, meaning prices for estates in the Wynaad (many of which remained in a neglected state following the coffee blight) rocketed. "This released a feverish speculation in England. 1879-1881 saw the establishment of no less than 41 mining companies with a total (nominal) capital of over £4 million. Numerous coffee estates in Nilgiri-Wynaad were taken over by the mining companies..." (Folke, 1966:208). Collapse came in the second half of 1881 when it emerged that the gold content was far below that which could be profitably exploited. "The gold rush claimed several lives, during the frantic search and more so after a £5,000,000 investment turned into only 30 ozs of gold dust" (Muthiah, 1993:34).[168] Shares dropped several hundred percent and the mining companies went into liquidation (Folke, 1966), and although coffee continues to be grown on the Nilgiris today, the cultivation was never revived to its former extent.

Experiments in cultivating tea were conducted in the 1830s,[169] and achieved moderate success, leading to the first 'field-scale' efforts to plant tea on the Nilgiris on the Thiashola and Dunsandle Estates in 1859 (Muthiah, 1993:27). However, the plant was not taken up commercially until the 1890s (Folke, 1966). In 1881, Geofry correctly predicted the shift from coffee to tea, "We are forced to the conclusion that this comparatively new industry – perhaps the newest on our mountains, - will soon become the very crown and glory of all our Indian exports" (1881:68). Chinese convict labour is believed to have played a crucial part in the industry's development as Tanna explains, "It is one of those facts falling within the stranger-than-fiction category that tea was introduced in the Nilgiris with Chinese seeds and initially raised with the technical know-how provided by some Chinamen in chains. These were probably prisoners brought to the District during the Opium War"

[168] For more details of the Wynaad gold rush, see Muthiah, 1993:34-35.
[169] Some of the first seeds were brought from China and planted in 1835 on the Experimental Farm at Ketti under the management of a French botanist Mr. Perrottet (Tanna, 1970).

(1970:16).[170] Chinese 'experts' were also employed on tea estates elsewhere in India[171], the Chinese praised as, "universally skilled and refined", their knowledge of tea providing them with further cachet (Sharma, 2009:1292).

In *The Neilgherry Tea Planter* (1870), James McPherson[172] discusses the suitability of the Nilgiris for tea, and explains that the 'Budaghas' (Badagas) were contracted to perform much of the estate work. During the 1890s, limited companies played a key role in the tea take-off. The area under tea is said to have risen from 300 acres in 1869 to between 3,000 and 4,000 acres in 1897. By 1900, there were around 6,000 acres of tea in the Nilgiris, tea becoming the primary plantation crop of the district in the first part of the twentieth century (Folke, 1966:209), the environmental conditions seemingly perfect. Census figures emphasize the dramatic shift, from 15,503 people employed in the cultivation of coffee in 1901 (compared to 2,712 employed in cultivating tea), by 1931 there were just 4,014 compared with 20,698 employed in tea (Folke, 1966:209).[173] This is not to say that tea has been on an undisturbed upward trend. "The post-War years were one of expansion in area and production which led to a short-lived but serious depression in the industry in 1920" (Muthiah, 1993:138).[174] But the estates recovered and by 1993 Nilgiri tea (figure 4.9) made up a significant proportion of the 175,000 tonnes produced in South India, figures which led Muthiah to declare, "...it is tea which makes the Nilgiris Plantation country" (1993:24).

Accordingly it is tea which features most prominently in the Nilgiri plantation literature, a body which remains surprisingly small. *Plantations in the Nilgiris – A Synoptic History* by the tea planter Kaku Tanna[175], is illustrative of, and open about this bias, describing itself as, "...a modest presentation of the history of the Plantations and in particular the developments of the Tea industry in the Nilgiris for the last ten decades" (1970:*forward*).

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170 Alternatively they may well have been among those transported to the Nilgiris to work the government cinchona plantations (see chapter 6).
171 See Sharma, 2009 on the Assam tea plantations.
172 Gold medallist, Madras for best tea successively from 1867-1869 (Tanna, 1970).
173 Folke recognises that these census figures may have been influenced by the slump and seasonal character of coffee labour.
174 Planye (1914-15) provides brief descriptions and some photographs of the the estates and factories on the Nilgiris prior to this slump.
175 Of the Glenmorgan estate.

The first rubber trees were planted at Nilambur in 1878 (Tanna, 1970), and in 1881 some plantings were made in the Government Botanical Garden at Burliar, while a number of planters experimented with growing rubber amongst coffee. "But the late discovery that Ceara rubber actually killed all the Coffee that was growing under it[s] shade, that the yield of Ceara rubber was variable and uncertain, the damage done to it by monkeys, pigs and porcupine and the general ignorance of tapping it, gradually led to the neglect of the experiment" (Tanna, 1970:44). By the turn of the century around 1,200 acres had been planted with rubber but by 1970 it was virtually extinct in the District (Tanna, 1970). Some also tried the cultivation of cardamom and pepper, but acreages remained largely insignificant.

Figure 4.9 - Advertisement for Nilgiri Tea

Source: *The Times*. Saturday September 15th, 1984. p.1, col.G.

The Nilgiri Planters' Association (NPA) was founded in 1891 (having its genesis in the Nilgiri Planting and Mining Association founded in the 1880s at the time of the gold rush, Muthiah, 1993:184). The NPA covered the whole of the District until the formation of the separate Nilgiri-Wynaad Planters' Association (NWPA) in 1918, the Nilgiri-Wynaad planters feeling that their problems were somewhat different from those of the rest of the Nilgiris. The NPA played an important role in the formation of the United Planters' Association of Southern India (UPASI) in 1893.[176] More detailed planting statistics can be derived from the *Planting Directories of South(ern) India* published by UPASI. The first attempt by UPASI to compile a planting directory was in the form of an appendix to the Book of Proceedings in 1896. New editions were published in 1897 and 1902 but then not until 1924,[177] when the accepted definition of an 'estate' was land being ten acres or more, under tea, coffee, cinchona, pepper, cardamoms or rubber.

4.4 Conclusion

This chapter has built on Morrison's attempt to redress the unbalanced view of Ootacamund, and hill stations more generally, as "a gay, frivolous social whirl where the Anglo-Indian could be swept up in enjoyment and briefly forget about the weary life on the Plains" (2000:29). These were not trivial places in the history of empire and his contention that Ootacamund has received "far too little attention" (2000:3) is also true. British settlement on the Nilgiris began as a convenient and healthy escape from the Indian plains, but gradually gained pace, and acquired significance in both the political and agricultural geography of the British Empire.

After the founding of the Government Botanical Garden in 1848, the region gained a reputation for achievement in all things horticultural, under the leadership of the Garden's Superintendent William McIvor. The next logical step was the establishment of plantation crops, which in turn served to increase the population of the hills, and to spread the Nilgiris' fame. Coffee, cinchona, tea (and gold) all took their turn as the favoured crop over the course of the nineteenth century, with pepper, cardamom and rubber cultivated on a smaller scale (Anstead, 1914–15).

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176 For more on the UPASI see Muthiah, 1993. Some history can also be found in the Annual planting directories that were compiled by the UPASI, see bibliography.
177 See Waddington, 1924.

By 1860, the Nilgiris had a significant planting community, and both amateurs and professional botanists had succeeded in acclimatizing a number of foreign plants to the hills, making Ootacamund the logical choice for the first British cinchona plantations. In the following chapters Ootacamund and the wider Nilgiri region will be re-positioned as a place of scientific knowledge production, and as Morrison concurs, we shall further prove how the settlement's role in, "improving the health, morale and longevity of the British serving in India can hardly be overestimated" (2000:32).

5 The Nilgiri Cinchona Experiment, 1860-1900

This chapter documents the main events (table 5.1) of the British cinchona experiment from its planning stages in the late 1850s up to 1900 and the end of the Victorian experiment, signaled by the decline of the Nilgiri plantations. This will provide a frame of reference for the remaining chapters, and begins to explore the role of networks and places in the experiment and the management of the plantations.

Table 5.1 - Timeline of Major Developments in the Nilgiri Cinchona Experiment

1860	First cinchonas arrive at Ootacamund in October, but are dead by the end of the year.
1861	More cinchona seeds and plants arrive at Ootacamund, Macpherson reports on the plantation sites prompting a G.O. to be issued ordering further propagation to be stopped and for the Dodabetta site to be abandoned (the G.O. is later modified), McIvor begins to plant out small numbers of cinchona in the open, orders begin to be taken for cinchona plants, work is begun on the plantations at Dodabetta and Naduvattam.
1862	Anderson delivers plants and seeds from Java to Ootacamund and attacks McIvor's methods, propagating house is completed, official arrangement with RBGK terminated, two limited companies formed to grow cinchona on the Nilgiris, Markham publishes *Travels in Peru and India...*
1863	Cinchonas offered for public sale from the Government Gardens, Ootacamund, resolution made to plant 150 acres of cinchona annually on the Nilgiris for at least ten years, work begins on three new plantation sites during the year (Wood and Hooker plots at Pykara, and a plot at Mailkoondah), results from the first chemical analysis of Nilgiri bark made available, McIvor publishes *Notes on the Propagation...*
1864	After labour shortages McIvor applies for 500 convicts to work the government plantations.
1865	Convicts arrive on the Nilgiris, Howard finds Nilgiri bark to be low in quinine, but rich in other alkaloids, *Cinchona ledgeriana* arrives in Java.
1866	Markham revisits the Nilgiri plantations and constructs a map to illustrate progress, John Broughton is appointed as government Quinologist on the Nilgiris.
1867	Commission appointed to inquire into the effectiveness of the cinchona alkaloids other than quinine and concludes that they are no less effective.

1868	Propagation efforts now to be limited, instead seed is distributed gratuitously to interested parties.
1869	Convict labour is discontinued, government plantations now cover 1,200 acres (the amount originally fixed as the limit), McIvor and Broughton asked to consider the future of the plantations and the best method for manufacture, Pykara and Mailkoondah plantations are offered for sale but no buyer is found.
1870	Broughton begins manufacturing a portion of the Nilgiri bark in his manufactory to produce 'amorphous quinine', with which he supplies the medical stores, the first bark auctions are held in Amsterdam.
1871	McIvor's mossing system of harvesting now being widely applied, regular consignments of government and privately grown bark are being sent to the London market from the Nilgiris.
1874	High prices are achieved at the London auctions for Nilgiri bark as a result of increased demand owing to the Franco-German war.
1873	Government concludes that Broughton's 'amorphous quinine' is being produced at a considerable loss and order its abandonment, Broughton resigns and disappears.
1876	McIvor dies unexpectedly and the government cinchona plantations are left without a Superintendent, control passes to the Commissioner of the Nilgiri District.
1877	Famine in much of South India means that plantation labour is plentiful on the Nilgiris, record prices are achieved for Nilgiri bark in London as a result of civil war in New Grenada but fall once South American imports resume.
1878	Campbell Walker surveys the government plantations and finds only the half the number of trees it was believed they contained, accusations of neglect on the government plantations proliferate.
1879	Jamaican bark enters the London market, Mailkoondah plantation abandoned.
1880	Acreage of cinchona in Ceylon surpasses that in the Madras presidency, Markham publishes *Peruvian Bark*.
1881	Control of the government plantations passes to the Forest Department.
1882	First auction of government bark held in Madras.
1883	Professor Lawson takes up his position as Superintendent of the plantations and begins to renovate the plantations, Henry Trimen reports on the plantations, Ceylon bark dominates the London market.
1884	Mr. Hooper is appointed as the new Quinologist and begins to undertake analysis for private producers as well as manufacturing alkaloid and quinine sulphate.
1887	Factory equipment arrives and the grinding of bark commences.
1890	Packets of quinine sulphate begin to be sold through District Collectors.

1893	Packets of quinine sulphate begin to be sold by Postal Department Officers.
1896	Professor Lawson dies at Madras, Standen is appointed in his place as Director of the newly constituted Cinchona Department, the remains of Wood plantation at Pykara are abandoned.
1897	Position of Quinologist abolished.

5.1 Motivations for the British Cinchona Experiment (1852-1860)

5.1.1 Fears of Extinction

By the beginning of the nineteenth century, all of the European empires were becoming increasingly concerned over the quality, quantity and price of the exported bark, especially as the cinchona producing countries gained their independence.[178] As Goss explains, "As the world wide demand for quinine grew, the governments of Peru and Bolivia increasingly controlled its collection and sale, holding hostage European imperial expansion" (2004:81). The traditional method of harvesting the wild bark through felling the tree led to the tree's death, and with the closure of the Jesuit missions, the principle previously imposed on the *cascarilleros* of replanting five cuttings in the form of a cross for every cinchona that was felled could no longer be enforced. The result was that, "...the collection and shipment of bark to Europe fell into the hands of speculators who did not bother with conservation principles. The systematic spoliation of the best trees from the forest gained increasing momentum" (Gramiccia, 1987a:7). Demand for the bark was at the same time on the increase, as a result of its growing application in tropical regions (principally South East Asia, India and Africa). "These areas were plagued by recurrent fevers (or malarias as they came to be known) which were hindering economic development and threatening their military domination" (Lee, 2002:193). Hopes were pinned on quinine to allow their safe occupation and administration by Europeans.

Rumours of the nearing extinction of the cinchona tree were not new, Humboldt had reported that 25000 cinchona trees were being destroyed every year during his visit to South America in 1801-02 (Anon, 1862a:12). However, during the mid-

[178] Peru in 1821, Ecuador in 1822 and Bolivia in 1825.

nineteenth century, scientific rhetoric was employed to meet the British pressures of environmentalist protection, capitalist development, and imperial expansion. The Briton (and more widely the European in general) now spoke on behalf of nature. Philip has asked whether the cinchona transfer should therefore be regarded as part of an "early environmentalist 'sustainability' discourse" (1999:120), the project conceived at a time when both, as Grove (1995) has explained, a wider concern for nature and the environment began to emerge, and when the professionalization of botany and geography began in earnest.[179]

5.1.2 Escalating Costs

The expense incurred through procuring cinchona bark from South America was a growing worry to the British Empire. By the 1850s, the financial costs of protecting its people were escalating, with the Indian Government alone spending £7,000 a year on imported cinchona bark (Williams, 1962). This figure led Muraleedharan to conclude, "*The dominant reasons* [for the transfer] *were largely, but not entirely, financial in nature*" (2005:33).[180] Markham recorded that during the years 1854-56, the outlay for bark in India averaged £12,000 a year, and that during the two years 1857-8 the cost was upwards of £53,000.[181] The exact quantity of cinchona bark being imported into England was and remains difficult to quantify with any accuracy. There being no duty, returns were not always carefully kept, and the fact that the bark arrived in packages of varying sizes (60-120lbs) further complicated the matter. However, in the period immediately prior to the expedition it is likely that imports amounted to around 1200000 lbs (Markham, 1862a:572).

The British were also keen to disrupt the Spanish monopoly on the precious drug. London was already the most important of the bark auctions[182] and Britain was therefore ideally positioned to control the market. A ready supply of quinine would also allow British commercial industry to expand into the tropical realm.

179 On the professionalization of botany also see Endersby, 2008.
180 Emphasis in original.
181 CN1. RGS. CRM/55.
182 For more on the bark auctions and market see Hamilton, 1883 and Beavan, 1901.

5.1.3 Humanitarian Aid

Clements Markham, self-appointed leader of the cinchona project, was adamant that a humanitarian motive should be central to the mission, the aim being to produce a cheap febrifuge for the masses, as opposed to the production of expensive sulphate of quinine exclusively for the European market. However, it was of course hoped that regular doses of a quinine based febrifuge would also decrease the number of European lives lost in the colonies, in turn enabling expansion into other hazardous tropical regions. The prospect of a "quinine famine" (Anon, 1862a:12)[183] was the source of growing apprehension, and Markham felt it was his duty to release the knowledge of the native Andeans to the rest of the world. The South American people would also benefit, through learning how to cultivate the tree for themselves (Muraleedharan, 2005, Markham, 1862). Markham projected a future with money and lives saved. The Secretary of State echoed Markham's thoughts whilst also recognising the potential economic returns offered by the scheme:

> The two first objects of the experiment are the provision of an abundant and certain supply of bark for the use of hospitals and troops, and the spread of cultivation through the hill districts in order to bring the remedy within the reach of the frequenters of jungles and the native population generally... the experiment cannot be regarded as a mere money-speculation, nor are the commercial advantages that may be derived from it to be considered as other than a secondary consideration, though, of course, a return of the outlay and the spread of cinchona cultivation by private enterprise are very desirable in themselves.[184]

In 1857, following Baikie's proof of quinine's "virtue as a prophylactic against malaria while sailing up the Niger" (Rocco, 2004:214), John Forbes Royle[185] had written formally to the EIC: "The almost inappreciable value of the cinchona, commonly called Peruvian bark... is universally acknowledged. Hence it becomes a duty to humanity... to increase the supply of cinchona trees which yield such valuable bark."[186]

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[183] See Anon, 1867a, for reference to a quinine famine in Mauritius.
[184] Secretary of State for India to His Excellency the Honourable the Governor in Council, Fort St. George, dated India Office, 2nd January 1863. BPP, 1863:255.
[185] For more on Royle see appendix B and Woodward, 2004.
[186] Report by Dr. Royle on the Introduction into India of the Quinine-yielding Cinchonas, and of the means, which have hitherto been adopted for the purpose, dated East India House, March 1857. BPP, 1863:15.

Britain was only too aware of the devastation and suffering caused by malaria[187] in its tropical possessions. "In nineteenth century India, when the population was only 100 million, malaria killed a million babies a year under the age of one, another million children between the ages of one and ten, and crippled another two million, mostly over ten, in a normal year" (Hobhouse, 1985:10). With the help of quinine, it was believed that the subjects and environments of the British Empire could progress along the development trajectory of savage to civilised, wild to cultivated, and local to global.

5.1.4 The Vision: British Cinchona in India

It is believed that the first suggestion that cinchona might be grown in India came from Dr. Ainslie in 1813 (Williams, 1962). This suggestion became more geographically specific in 1831, after Henry Piddington, a colonial scientist specialising in the law of storms, chemistry and mineral properties in India published a short paper, 'On the soil in which the Cinchona thrives' in which he recommended Sylhet and Cachar[188] as the best areas for cinchona plantations (Mukherjee, 1998:85).

Asked to report on the matter, John Forbes Royle wrote to his superiors warning them that the *Cinchona calisaya* forests in South America were being cut down so fast they would soon be destroyed. Royle had already voiced his recommendation for the introduction of cinchona into India in his publication *Illustrations of the Botany, &c., of the Himalayan Mountains* (1839), being of the opinion that, "...among the vast variety of medicinal drugs produced in various parts of the world, there is not one, with probably the single exception of opium, which is more valuable to man than the quinine yielding cinchona."[189] Royle's report also brought to the notice of government recent developments in South America:

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[187] It should be recalled from that the remittent fever remained unnamed for much of the nineteenth century.
[188] These were in northeastern India; Sylhet is now part of Bangladesh.
[189] Report on the Introduction into India of the Quinine-yielding Cinchonas, or Peruvian Bark Trees, by Dr. Royle, dated India House, 27th June 1852. BPP, 1863:1.

> ... A national bank of bark has been established since January 1850, 'with sufficient funds to give regularity to the bark trade,' 'purchasing it in the interior of the country at a fixed price,' and 'selling it abroad at the value due to an article of exclusive production in the woods of Bolivia, and of the first necessity and great demand in the trade of the world.' 'The free export of bark,' it is stated, 'would be fatal to our commerce,' as 'bringing down the price.' 'Consequently the bank maintains the monopoly, and with it the high value and price of bark'.[190]

1854 saw the first attempt to introduce cinchona to India, when Royle applied to and obtained from Kew, the Botanic Gardens at Edinburgh, and the Horticultural Society at Chiswick, six of the *Cinchona calisaya* plants which Weddell had brought back from South America. Robert Fortune,[191] who at that time was proceeding overland on his mission to China to obtain tea seeds and plants, "...was requested to take charge of these plants, which he himself packed into a small Ward's case. These were conveyed by him along with the passengers of the mail of January, 1854, across the desert, and five of the plants safely reached the Calcutta Botanic Gardens, then under the superintendence of Dr. Falconer" (RBGK, 1931:114). When they did not do well at Calcutta, the plants were sent onto Darjeeling, where three arrived alive. However the final report announced, "All the cinchonas were killed by the cold of last winter" (RBGK, 1931:114). In June 1855 the Medical Board suggested to the Government of India that the experiment should be re-tried on a more extensive scale.

When Dr. Cleghorn visited the Government Gardens at Ootacamund in 1857[192] he was able to report that, "Two Cinchonaceaous plants from Patagonia received from Mr. Lobb[193] under the name of Cinchona micrantha... are in the Garden, but they appear to suffer from the misty atmosphere. It is of the utmost consequence, that the introduction of the true Cinchonas should be fairly tried on the Neilgherries, and Mr. McIvor is well able to conduct the experiment."[194] The Agri-Horticultural Society of India (based in Calcutta) added their support for the introduction of

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[190] *Ibid.* BPP, 1863:2. It is not clear whom Royle is quoting from.
[191] See Rose, 2009.
[192] In his capacity as Professor of Botany to the Chief Secretary to Government, Fort Saint George.
[193] Thomas and William Lobb were English plant collectors, employed by Veitch Nurseries of Exeter, who were sent out by the company to various parts of the world, with the primary aim of obtaining new species for the gardens of Europeans. Whilst William collected extensively in the Americas between 1840 and 1853, and is particularly remembered for the introduction of the Monkey-Puzzle tree, Thomas worked in India, Indonesia and the Philippines.
[194] BL. RHBGO, 1856-1857. Cleghorn's comments, p.4.

cinchona into India in the same year, also appealing to the authorities for a trial of Atees (*Aconitum heterophyllum*) as an alternative antidote for malaria.[195]

In spite of Royle's death in 1858, the cinchona expedition continued to gather support back in London. Clements Markham (figure 5.1), a clerk at the India Office, who would later find fame as a geographer, nominated himself to lead the expedition (emphasizing his knowledge of South America, rather than any botanical credentials).

> I am well acquainted with several of the forests in Peru, and on the frontiers of Bolivia, containing the cinchona tree. I already know three of the more useful species by sight, and should be able to acquire a thorough knowledge of the others before leaving England. I know not only the Spanish language, but also the Quichua, or the language spoken by the Indians of those districts; and I am intimate with many of the public men, and the landowners on the eastern slopes of the Cordillera.[196]

On April 23rd 1859 Markham was brought before the revenue committee to read his detailed plans and present a rough estimate of his expenses.[197] He read widely on the subject of cinchona, and met with individuals possessing important practical knowledge or manufactured items he would need for the expedition including; "J.E.Howard, Lordship Lane, Tottenham (manufacture of quinine) – meeting Friday at 4pm May 20th, J. Carleys a builder at Richmond (for Ward's cases), Cogswell, 224 Strand (revolver), Edgington, 32, Charing Cross (tent), Stewart, Strand (microscope), Wilson, geologist, J. Fortune..."[198] On July 8th the Revenue Committee sanctioned an expenditure of £45 for Ward's cases; and engaged Mr. Flood, a young gardener formerly in the North Australian expedition as Markham's expedition assistant[199] (Flood would later be replaced by Robert Weir). Markham also visited the experimental tropical garden of the 'Tropical Gardens Company' at Highgate where cinchonas were already growing.[200]

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195 "This plant was used in India from time immemorial and it was referred to by Nathaniel Wallich of the Calcutta Botanic Garden in his famous *Plantae Asiaticae Rariores* (London, 1832) as one of the principal Indian medicinal plants" (Mukherjee, 1998:97).
196 Clements Markham to Sir George Clerk, dated India Office, 5th April 1859. BPP, 1863:21.
197 CN1:71. RGS. CRM/55.
198 *Ibid.* Inside cover.
199 *Ibid.* p.72.
200 *Ibid.* p.171. Unfortunatley I have been unable to find any further information about the 'Tropical Gardens Company'.

Figure 5.1 - Sir Clements Robert Markham by George Henry (1913)

Source: RGS Picture Library.[201]

Markham was aware that the Dutch already had cinchonas thirty feet high in the hills of Java,[202] and during November 1858, Sir William Hooker of Kew had written that the only reason Britain did not have similar plantations in India was, "for want of some energetic practical man to direct such operations."[203]

Although Royle, Falconer and others had recommended cultivation in the Bengal Presidency, Markham declared that it was the Nilgiris which would be the best home for the cinchonas (figures 5.3 and 5.4), a decision he seemed very satisfied with after visiting the Nilgiris for himself: "Here are to be found a climate, an amount of moisture, a vegetation, and an elevation above the sea, more analogous to those of the chinchona forests in South America than can be met with in any other part of India" (Markham, 1862a:339). Markham did not visit any part of the Bengal Presidency whilst he was in India in 1860-61, and dismissed the Himalayan range as unsuitable,[204] although he was hopeful that the cultivation would in due course be introduced into the other hill districts of South India (Markham, 1862a:339).

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[201] This portrait hangs in the RGS, London. Note the painting of cinchona hanging behind Markham.
[202] CN1:55. RGS. CRM/55.
[203] *Ibid.* p.63.
[204] Mukherjee seeks to draw attention away from the Nilgiri plantations and towards those which were established slightly later in Darjeeling, "Not only was the Himalayan range suitable for the culture of Cinchona, it proved the only suitable area in British India where the best species, *C.Calisaya* could be successfully grown…More importantly, *C. Ledgeriana*, the finest Bolivian variety of *C. Calisaya*, which thrived on Javanese soil, was cultivated very successfully in Mungpoo near Darjeeling which had no equal in India" (1998:88).

The 1859-60 British expedition to South America was split into three separate missions coordinated by Markham. He would go to Bolivia with his wife Minna, and would be assisted by the Kew gardener Robert Weir, Richard Spruce would be assisted by another Kew gardener Robert Cross in Ecuador, and another collector Mr. Pritchettt would focus his efforts on the Peruvian cinchonas (figure 5.2). The expedition is to date the best documented stage of the cinchona experiment[205] and so no detailed account of the team's dramatic adventures is included here. However, it should be noted that the export of cinchona plants and seeds from South America was controversial, and conducted without the permission of the respective national authorities, an act which formed part of a far wider pattern of global plant exchange in the eighteenth and nineteenth centuries. Markham justified his bio-piracy on two counts; that there was at the time of his expedition no law banning the export of the tree (although a decree to that effect was passed by the Ecuadorian government in May 1861), and second that he believed the act would ultimately benefit the South American people (see Muraleedharan, 2005:34-35). Botanical networks held great importance in the world economy of this time, and the journey cinchona made from South America to India in 1860 is a transfer which Kavita Philip depicts as being loaded with "symbolic and ideological significance" (1999:120), largely as a result of its global scale of operation (involving activity on three continents), and operation in the public eye, the plant transformed forever from wild tree to cultivated crop.

Whilst the three sub-teams were gathering plants and seeds in Peru, Ecuador and Bolivia, McIvor was already beginning to think about where he was going to plant them:

> Much depends for its success on a careful selection of sites in the first instance, as any failure in the first attempt will prove seriously discouraging in the cultivation of this important product... I think from the nature of the plant that a good locality might be had immediately adjoining the upper portion of the gardens, extending up a well-watered nála towards Dodabetta.[206]

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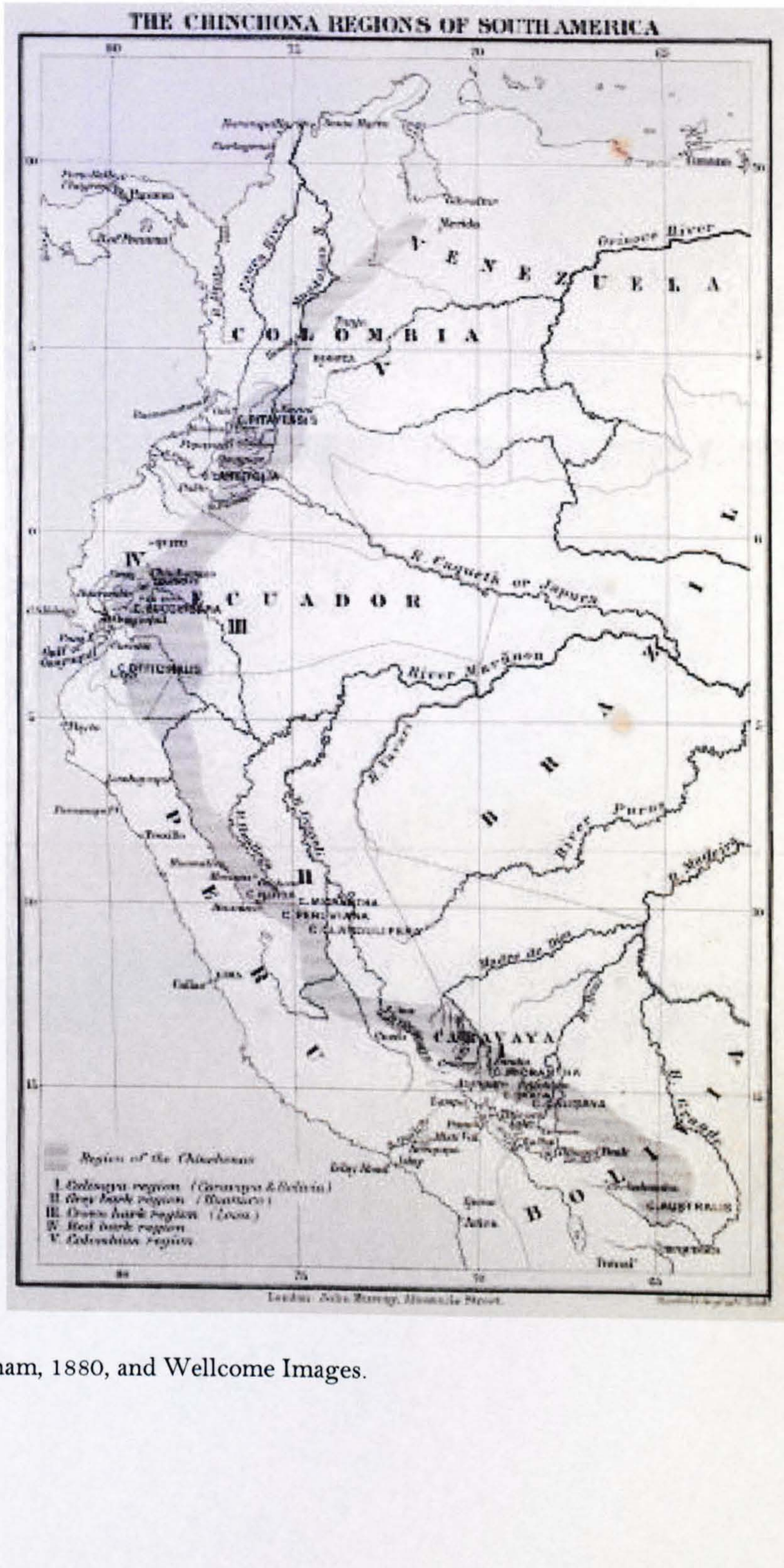
[205] See Williams, 1962, Honigsbaum, 2002 and Rocco, 2004, and for personal accounts from those involved see the expedition reports (Cross, 1861 and Spruce, 1861-62), and Markham, 1862a and 1862b.
[206] BL. RHBGO, 1858-1859:11.

Figure 5.2 - The Cinchona Regions of South America

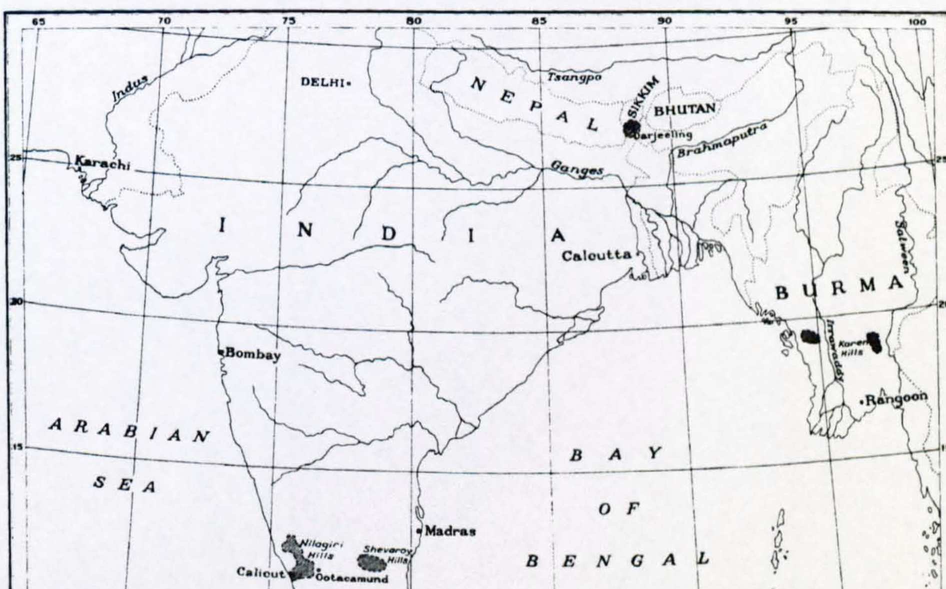


Source: Markham, 1880, and Wellcome Images.

Figure 5.3 - A Map of India with the Chinchona Plantations and Lines of Rainfall

Source: Markham, 1880, and Wellcome Images.

Figure 5.4 - Cinchona Plantations of British India and Burma



Source: Williams, 1962:426, after Markham, 1880 (figure 5.3).

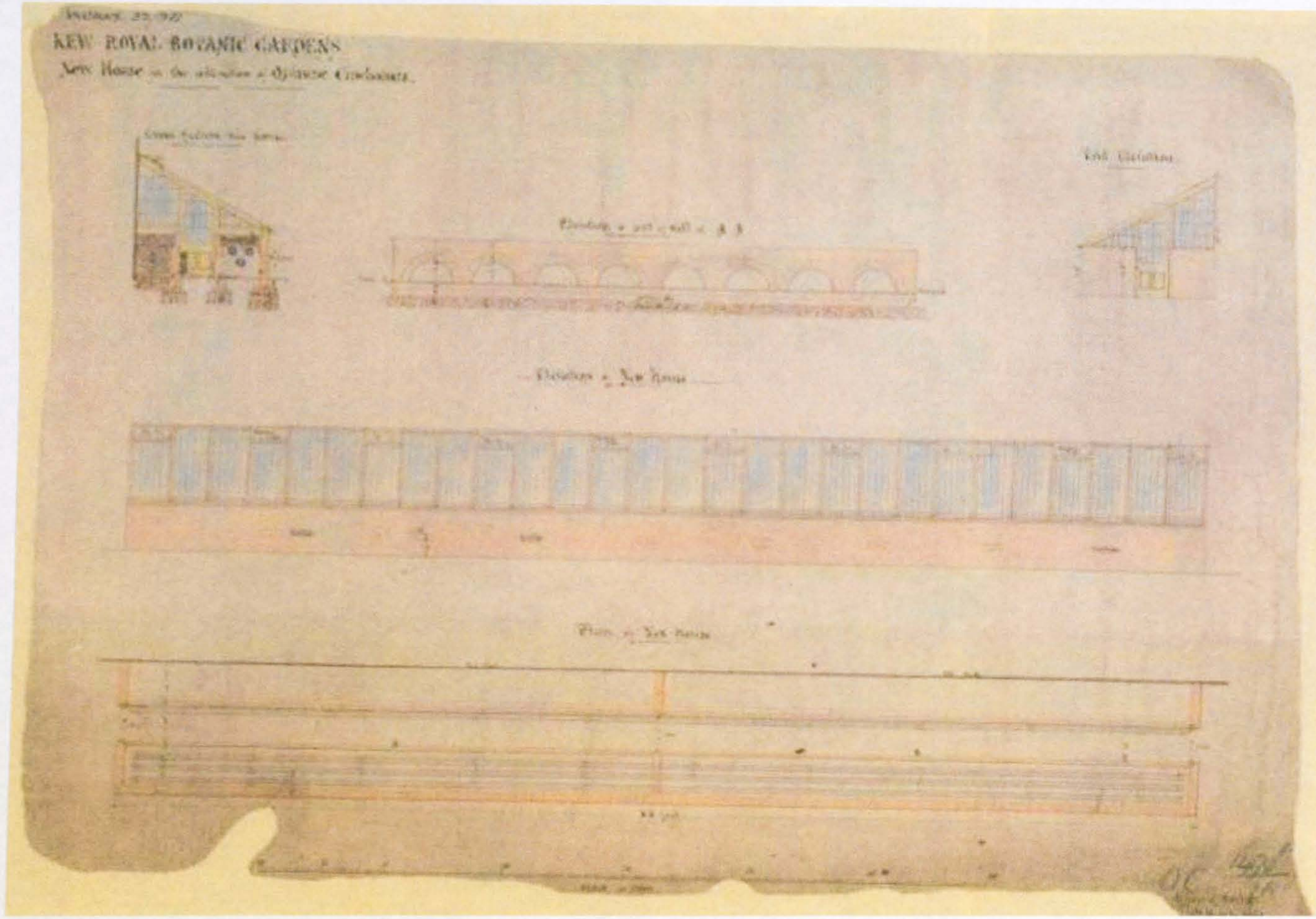
Preparations for the arrival of the cinchona plants were also being made at Kew, in the form of a purpose-built forcing house commissioned at the request of Charles Wood (Williams, 1962:434 and figure 5.5). In order to guard against accident, it was planned that a portion of the cinchonas gathered by Markham and his team would be retained at the gardens as a kind of reserve depot, where they would also offer the opportunity for close observation and experiment (Markham, 1862a:334). In a letter dated 6th June 1860, Sir William Hooker wrote to Herman Merivale (Under Secretary of State for India):

> India is a fruitful source of riches to our establishment:- and more I hope, through us, some little benefits will arise to India, by our rearing lots of cinchona plants from seed, we daily expect to receive from Peru - & then to be transmitted to your professions in India. Our propagating huts erected for this purpose, are now finished, and I must confess I now feel a very great interest in the success of this enterprise, which I trust may turn out as advantageous to India as tea cultivation is now become.[207]

Kew also played a part in "...recommending competent gardeners to take charge of the living plants from the native forests to the hill country of India, and to have the care of the new plantation there" (RBGK, 1931:115).

[207] BL. Eur Mss A.170.

Figure 5.5 – Plan of Cinchona Propagating House at Kew, 1860[208]



Source: TNA. WORK/32/381.

[208] This structure (88ft long and 10 ft high) stood from 1861 until demolition in 1901 (Desmond, 1995).

5.2 The First Nilgiri Cinchonas (*c.*1860-1862)

Clements and Minna Markham were the first members of the expedition team to return from South America, docking at Southampton on 28th July 1860. Markham wrote to his friend Richard Henry Major[209] on the 3rd August from the Union Club, Trafalgar Square, "...you will be glad to hear that I have returned here, with a large collection of cinchona plants in good condition, on their way to India: but I am off again on the 27th. I hope however, to come home for good in March of next year."[210] Keeping to schedule, Markham, accompanied once again by Minna, embarked with the plants, still looking "most flourishing"[211] on the 27th August. Minna provides an account of their sea voyage in her diary, through the Bay of Biscay to the blue Mediterranean and onto Egypt. Onwards then to Suez "a dreadful place" where events took a turn for the worse, "...heard that one of our best cases with 25 plants had fallen into the water and of course were killed by the salt waters..."[212] Reaching the Red Sea in mid-September, Minna records,

> ...a crash was heard and the steamer stood still. I went to see what was the matter and came back with the intelligence that the engines had broken down! And we could not go on! And of all places in the world to break down, the 'Red Sea' the hottest of all hot places!![213]

This stoppage, of around 24 hours, would later often be blamed for the ultimate failure of Markham's plants (see Williams, 1962).

5.2.1 The Markhams at Ootacamund

The Markhams came to anchor at Calicut on Sunday 7th October where they were met by Mr. Grant (Collector of Malabar) and shortly afterwards by McIvor. Minna's anxiety about the journey ahead is evident from her diary entry, "Mr. McIvor has come down from Uttakamund [Ootacamund] to meet us and the plants; we shall be 4 or 5 days on the road riding all the way and it seems to me we are either to be eaten by tigers or trampled by wild elephants!"[214] After travelling some distance by canoe, the group (and plants) began the ascent to Ootacamund, a

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209 Later to become Keeper of Maps and Plans at the British Museum 1867-80.
210 BL. Eur Mss A.82.
211 MMD entry for 27th August 1860. RGS. CRM/23.
212 *Ibid.* Entry for 13th September 1860.
213 *Ibid.* Entry for 16th September 1860.
214 *Ibid.* Entry for 7th October 1860.

distance of 33 miles, Minna observing, "The poor coolies (150) who had serviced the cases from the low countries, felt the cold terribly and cowered about shivering, holding lighted sticks to warm themselves. Fresh coolies are here, so the poor things will soon be back in warm regions…"[215] On reaching Ooty, the Markhams settled into Lawson's Hotel where they found themselves:

> …in the midst of a large garden full of flowers… it is difficult to believe that we are in India. This place is so very like England, like Malvern on a large scale surrounded by high grassy hills and the streets, the bungalows, all scattered about in their compounds, it is cold here, being 8,000 ft above the sea. Our luggage and the plants arrived late, of the latter, Mr. McIvor gives but a bad report.[216]

The Markhams and McIvor rapidly came to the conclusion that blame for the poor condition of the plants lay firmly with Weir (Markham's gardening assistant in South America who was currently en route to India), who had apparently planted them in mud, killing their roots. As Minna recorded, "Mr. McIvor says that not even a willow could have lived in such mud!"[217]

The following week the Markhams travelled with the McIvors (William and his wife Anne) to see the proposed plantation site at Dodabetta, which Minna described in her diary:

> …it is situated in a sholah (a wooded ravine), a good deal higher than the Botanical gardens, heard several monkeys leaping about among the trees; we then went on to Dodabetta, the highest peak of the Nilgiris….Dined with the McIvors and returned in a tremendous storm of thunder and lightning accompanied by torrents of rain.[218]

The early part of the Markhams' stay continued to be dominated by heavy rain from the Madras or north-east monsoon,[219] and on October 24th, Markham was forced to admit,

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215 *Ibid.* Entry for 9th October 1860.
216 *Ibid.* Entry for 11th October 1860.
217 *Ibid.* Entry for 11th October1860.
218 *Ibid.* Entry for 15th October 1860.
219 See CRMD1 entries for October. RGS. CRM/67.

> These wet days have destroyed all hopes of the cuttings, they have, for the last week, been in the same kind of atmosphere as they were in the wardian cases. It causes decay, and enables it to spread with fearful rapidity. The cuttings are nearly all drooping and looking sickly. We shall make a last despairing attempt to save the best, by putting them in Waltonian cases[220] and giving them bottom heat. The stumps are more hopeful.[221]

Despite the dedicated efforts of McIvor, and the regular visits of Markham and Minna, the cuttings continued to rot, and the Markhams remained very much at the beck and call of the plants, "A terrible account of the plants came up from Mr. McIvor – all, he feared, were more or less tainted with disease. Hurried down at once."[222] To dampen spirits further, Markham had also received news that the now resented Weir was on his way to Ootacamund. "I had telegraphed and written to Bombay to say he was not wanted; but, unfortunately he had been sent off... the day before I telegraphed from here. He must have been near three weeks at sea."[223]

As weather improved in November, the Markhams and McIvor rode out to Naduvattam[224] in search of a second suitable site for the cinchonas, at a lower elevation than that already selected.

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[220] In his diary entry for the 27th October 1860, Markham provides a detailed account of the Waltonian method, "Waltonian cases have been constructed out of the old Wardian cases. The case is set upon legs, 2 feet from the ground, and all the top and sashes removed. A shallow cistern is then placed in the bottom, about 3 inches deep and a portion of the wire netting placed over it. The cistern was then filled with boiling water and two lamps placed underneath (tumblers of water with an inch thick of cocoa nut oil on the top, in which a lighter wick floats); layers of moss were then put on the wire netting, with soil over it, on which the pots were put. The interstices were then filled in with earth. A bottom heat has thus been given to the pots of 75, in order that the roots may be forced out of the cuttings, if it yet be forcible. There was still a feeling of reluctance to put the pots containing the stumps on Waltonian cases, because the warmth, though it tends to draw out the roots, also increases the rapid spread of decay if it exists. It is very difficult to know what to do, danger surrounds the life of the poor cinchona plants on all sides, and it has now become a most delicate operation – the chances appear equally balanced whether we save even one. A fearful time of anxiety – nearly worn out" (CRMD1. RGS. CRM/67).

[221] CRMD1 entry for October 24th 1860. RGS. CRM/67.

[222] *Ibid.* Entry for 31st October 1860.

[223] *Ibid.* Entry for 8th November 1860.

[224] The spelling of this village on the north-west slopes of the Nilgiri Hills between Gudalur and Ootacamund (around twenty miles from Ootacamund) varies considerably in the sources. This modern spelling is used throughout the main body of text. "The name of the village is supposed to be derived either from nadu 'centre' or nidu 'long' and vattam 'a valley,' and thus to mean either 'central valley' or 'long valley'" (Francis, 1908:356).

> The jungle is at an elevation of about 5000 feet and extends to the verge of the steep descent into the table land of Wynaud, just above several coffee plantations. One, just beneath our feet, belongs to a Captain Scott, another close by though not in sight, is worked by Mr. Ouchterlony[225] of Ootacamund. There is a good supply of water in the forest; the soil is rich, the base being a mixture of syanite and laterite curiously combined... I thought it well suited for the site of a cinchona plantation; and certainly a more lovely spot I scarcely ever seen...[226]

Weir arrived on the 12th November, appearing, according to Minna, "...as dismal gloomy and provoking as ever,"[227] and a few days later Markham set off for a fortnight's tour of the coffee plantations. When he returned, all the cuttings had been lost, leaving him "almost in despair."[228] Come Christmas, the other collections had still not arrived, and Markham's plants had further diminished. The Markhams decided against delaying their departure any longer and left the Nilgiris on the 10th January 1861, when just eight wood cuttings remained clinging on to life.[229]

Just prior to leaving India, Markham wrote to the Under Secretary of State for India to report on the present prospects of the project.

> It is with deep regret that, in the first place, I have to report that the sanguine hopes of the final recovery of the collection of plants which arrived in the Neilgherry Hills last October... have been disappointed... The loss of the Cinchona plants, which I had collected with so much labour and difficulty in the Peruvian forests, is most disastrous, but not I trust irreparable.[230]

Pritchett's seeds (of *Cinchona nitida* and *Cinchona micrantha*) finally arrived on the 13th January, and were sown by McIvor the following day. A packet had also been sent to Mr. Thwaites (Superintendent of the Botanical Gardens at Peradeniya) in Ceylon. Seeds of the 'red-bark' species followed at the end of February.

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225 See chapter 4 for more on Ouchterlony.
226 CRMD1 entry for 6th November 1860. RGS. CRM/67.
227 MMD entry for 12th November 1860. RGS. CRM/23.
228 CRMD2 entry for 10th December 1860. RGS. CRM/68.
229 *Ibid.* Entry for 9th January 1861.
230 Markham to Under Secretary of State for India, dated Bombay 26th February 1861. BPP, 1863:139.

5.2.2 Attacks and Setbacks

Dr. Macpherson (Inspector General of Hospitals in Madras) was now at Ootacamund, following government instructions to inspect and report on the sites selected for the "experimental nursery and plantation" through a comparison to the successful examples he'd observed on a recent visit to Java.[231] His subsequent report was damming of the plantations and McIvor, urging the government to employ a Dutch Superintendent who would possess specialist knowledge of the subject. Following Macpherson's comments a G.O. "ordering all further propagation of seed to be put a stop to in the glass-house at Ootacamund," and for the Dodabetta site to be abandoned was issued.[232]

McIvor, supported by Captain Morgan (officiating Conservator of Forests) protested against the G.O., questioning Macpherson's right to authority, and dismissing his report as inaccurate, whilst demonstrating an awareness of the importance of using cultivation techniques that were adapted to the local conditions of the Nilgiris, rather than strictly following the Dutch mode.[233] He promised that if placed in full charge of the cinchona experiment, he would take full responsibility for its success or failure, having by this time successfully raised 172 seedlings from Pritchett's collection.[234] After further support was received from Markham, the G.O. was modified, granting permission to McIvor to continue operations at Dodabetta and to retain plants and seeds at the gardens until the Naduvattam site was ready (having been delayed by Macpherson's comments), upon which time the Government wished expedition member Robert Cross to take care of it.[235]

Cross[236] had recently arrived at Southampton with fifteen Wards cases stocked with *Cinchona succirubra*, from where he immediately proceeded to Kew.[237] Leaving behind a small number of plants as reserves, he then travelled on to India, arriving

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[231] Macpherson to J.D. Bourdillon, Secretary to Government, dated 5th February 1861. BPP, 1863:147.
[232] Captain Morgan to J.D. Bourdillon (Secretary to Government, Revenue Department), dated 28th March 1861. BPP, 1863:153.
[233] McIvor to J. D. Bourdillon, dated 30th March 1861. BPP, 1863:158.
[234] Pritchett's seeds had also germinated at Kew and Jamaica. Both of these places were deemed to be "depots to fall back upon" (Markham to Under Secretary of State for India, dated Valetta, 8th April 1861. BPP, 1863:166).
[235] Government of Madras to Sir Charles Wood, dated Madras, 6th July 1861. BPP, 1863:185.
[236] See appendix B for a short biography of Cross.
[237] Herman Merrivale (India Office) to William Hooker (Kew Gardens), dated 18th February 1861. RBGK, IEPC.

at Ootacamund on the 9th April 1861, with 463 plants of *Cinchona succirubra* and six of *Cinchona calisaya* "all in good order"[238] (figures 5.6 and 5.7).

Figure 5.6 – Cinchonas Arriving at Ootacamund, 9th April 1861

Source: Unknown photographer, the cinchonas pictured are presumably those gathered by Robert Cross. www.plantcultures.org.

Figure 5.7 – "Chinchona-plants at Ootacamund, in August 1861 (from a photograph). A flowering branch of Chinchona in the foreground."

Source: Williams, 1962:434. The illustration was used as the frontispiece of Markham, 1862a, and is obviously drawn from figure 5.6.

[238] Government of Madras to Sir Charles Wood, dated Madras, 24th April 1861. BPP, 1863:164.

McIvor was soon "certain of saving four, and perhaps 5" of Cross' six *Cinchona calisayas*[239], and the whole of the *Cinchona succirubra.* Their arrival, rather than that of his own plants (for which there is no similar photograph or pictorial representation), signaled the commencement of the experiment proper to Markham (see Markham, 1862a:486).

Rates of germination quickly improved through the use of more open soil and immediate transplanting into fresh earth following germination. Cross' imports had by December produced several thousand by propagation and McIvor predicted that 2-3,000 new plants could now be produced monthly at Ootacamund. This was welcome news as the Governments of Ecuador and Peru had recently issued decrees making the export of cinchona a felony.[240]

Following negotiations with the Dutch Government, Thomas Anderson (Superintendent of the Calcutta Botanic Gardens) was sent out to Java in late 1861 to receive 56 *Cinchona calisaya,* 350 *Cinchona pahudiana* and six *Cinchona lancifolia,* alongside 400,000 *Cinchona pahudiana* seed.[241] This reciprocity continued to characterize the relationship between the two empires for the entirety of the British project, although the *Cinchona pahudiana* was revealed as worthless even before it had reached the Nilgiris. On the Nilgiris Anderson received instruction in McIvor's methods of propagation, and was furnished with plans of the propagating house, "in order that he may erect two similar buildings on the Himalayas."[242] However, perhaps resentful that McIvor and the Nilgiris had been chosen to lead the project, Anderson became the second individual in a matter of months to heavily criticize McIvor to government, questioning his methods (in particular his plan to plant out 75 acres of Cinchona plants without the shade of forest trees), and the early success of the Nilgiri project:

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239 Markham to the Under Secretary of State for India, dated Torquay, 30th May 1861. BPP, 1863:166.
240 McIvor, 1862?:3. Later collecting trips managed to evade these decrees.
241 Anderson to W. Grey (Secretary to the Government of India), dated 4th December 1861. BPP, 1863:189.
242 McIvor to T. Pycroft, dated 20th January 1862. BPP, 1863:194.

> I maintain that the successful rearing of the cinchonas in the greenhouses at Ootacamund is no more a proof that the climate of the Neilgherries is adapted for their cultivation than the fact that many thousands of seedlings, as well as cuttings, are now existing in perfect health in the chinchona nursery at Kew, would lead us to expect that the plants will grow in the open air of England.[243]

Anderson later attacked the quality of the 170 plants he'd received from Ootacamund; comparing them to the "strikingly more healthy" specimens he had obtained from Java.[244] Williams depicts Anderson's attack as an attempt to belittle Markham (rather than McIvor), actuated by 'scientific jealousy', and originally acting with the support of Governor of Madras Sir William Denison. However, "Early in 1862 Denison reconsidered his verdict in the light of the support given to McIvor by the competent Robert [Richard] Spruce... Denison thought that 'when Doctors disagree' only experiment could provide the answer" (Williams, 1962:437).

From July 1861, monthly reports were issued which provided figures on the total numbers of cinchonas of the different varieties present on the Nilgiris, numbers planted out in the plantations, and numbers distributed (table 5.2).

At the close of the first full year of the cinchona experiment at Ootacamund, the global reach of the experiment was already starkly apparent, "...we now possess upwards of 5,000 plants at Kew, a number of plants in the West Indies, 840 in Ceylon, on the 28th September last; about 80 plants in Calcutta, and at Ootacamund, on the Neilgherries, about 9,000 plants" (McIvor, 1862?:1).[245] McIvor believed the most valuable species (*Cinchona succirubra*) had been secured to India, and was benefiting from the same extraordinary rates of growth experienced by garden produce on the hills. "The size of the largest leaf is given at 7½ inches in their native localities, while our leaves are, as before stated, 12 by 18 inches" (McIvor, 1862?:4). In Ceylon, a Mr. McNicholl had been sent out from Kew to take charge of the cinchona plants on the island,[246] and coffee planters were showing an interest in experimenting with cinchona.

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[243] Quoted in McIvor to J.D. Sim (Secretary to Government, Revenue Department), dated Ootacamund 9th May 1862. BPP, 1863:217.
[244] Thomas Anderson to W. Grey, dated 11th February 1862. BPP, 1863:201.
[245] The plants on the Nilgiris were comprised of, 3,477 plants of the red bark (*Cinchona succirubra*), many of which were from 3ft to 3ft 9in in height, and 2,370 of other kinds equally healthy (Hooker, 1861 in RBGK, 1931:115-116).
[246] Ceylon, Royal Botanic Garden. Report for 1861 by Mr. Thwaites. BPP, 1863:269.

Table 5.2 - First Cinchona Report, 9th July 1861

— No. 90.—

REPORT on the Number and Condition of the Cinchona Plants in the Government Gardens at Ootacamund, on the 9th July 1861.

NAMES.	NUMBER.	REMARKS.
Cinchona succirubra, or Red Bark -	1,204	The imported plants are in a very healthy and flourishing condition, the leaves on some of the red bark plants measuring 11 × 7 inches. Average growth of the month, 1½ inches; height of largest plants, from 2 feet 4 inches to two feet 7 inches. The first of the seedlings are 4½ inches high, and furnished with from two to three pairs of branches; some of the leaves measure 2½ × 1½ inches. Average growth of the month, 1½ inches. More seedlings are coming up daily.
Cinchona calisaya, Calisaya Bark -	6	
Cinchona nitida, genuine Grey Bark - - - - - -	714	
Cinchona micrantha, var. Provinciana - - - - -	802	
Cinchona micrantha, var. Pata de Gallinazo - - - - -	36	
Species without name - - -	211	
TOTAL - - -	2,973	

Government Gardens, Ootacamund,
9th July 1861.

(signed) *W. G. McIvor*,
Superintendent Botanical Gardens.

Source: BPP, 1863:192.

5.3 A Furore for Cinchona (*c.* 1862-1880)

5.3.1 Dissemination and Planting

By the 1st January 1862, a built-for-purpose propagating house was in full working order at Ootacamund. [247] The official arrangement between the RBGK and the India Office was to be terminated on 29th March,[248] "in consequence of the success which has attended the cultivation of the chinchona plant in the Government gardens at Ootacamund..."[249] although the authorities at Kew would retain a strong and influential role in the cinchona experiment for the remainder of its duration.[250]

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[247] AAR, 1861-62. BPP, 1863: 240. More detail on propagation methods is provided in the following chapter.
[248] Herman Merrivale to the Under Secretary of State for Foreign Affairs, dated India Office 29th March 1862. BPP, 1863:272.
[249] Herman Merrivale to Sir William Hooker, dated India Office 28th March 1862. BPP, 1863:272.
[250] Annual progress reports were also included in the Kew annual reports until 1874.

By the summer of 1862, progress with propagation had been such that McIvor believed that plants should be offered for sale to the public from January at the following rates, "500 rupees per 1,000; 300 rupees for 500; 200 rupees for 150; 100 rupees for 50, or 4 rupees [equivalent to 6d[251]] per plant for any number under 50".[252] Public interest in the crop was growing and applications for plants had already been received from planters in both the Madras and Bombay Presidencies. This early enthusiasm was only boosted when Spruce wrote from South America in June that, "At this moment, people are digging up old roots, the scanty supply of bark thus obtained being all that is now to be had there."[253]

The government experiment was also attracting the attention of British citizens back home. In spite of having to wait around nine or ten years for any return on their initial investment (estimated by Denison to amount to 100 *l* per acre),[254] and spurred on by the promised merits of cinchona cultivation (including large profits), several groups of people took their interest a step further and formed limited companies with the aim of cultivating cinchona (often in association with other crops) in the Nilgiri region. The first two were formed in London during 1862.[255] Arthur Rowley Lascelles, agent for the Western Neilgherry Coffee, Tea and Cinchona Plantations Company, was one of the first people to place an order with McIvor for cinchona plants (numbering 10,000).[256] However, in common with several other cinchona ventures, the company never really got off the ground, being eventually dissolved by notice in the *London Gazette* on the 7th March 1882.[257]

From very unsteady beginnings, in November 1862 *The Times* was able to report,

251 Government of Madras to Sir Charles Wood, dated 23rd October 1862. BPP, 1863:247.
252 AAR, 1861-1862. BPP, 1863:243.
253 Note on the Cultivation of Chinchonae by Mr Spruce, dated June 1862. BPP, 1863:228.
254 Minute by Sir W Denison, dated September 1862. BPP, 1863:245.
255 These were the Nilgiri Gold and Cinchona Company and the Western Neilgherry Coffee, Tea and Cinchona Company. See TNA BT31/716/109C and BT31/ 2809/ 15386 and letter from Secretary of State for India to His Excellency the Honorable the Governor in Council, dated 2nd January 1863. BPP, 1863:255.
256 McIvor to J.D. Sim, dated Ootacamund 27th June 1862. BPP, 1863:243.
257 TNA. BT 31/716/109c.

> There is now a prospect that in various districts of India, and even in Ceylon, cinchona will be reared and become an important item in the table of our Indian exports. In India itself an ample supply of this drug will be an immense boon and benefit. Since quinine has been extensively used among our troops there, there has been a steady diminution in the percentage of mortality. Whereas in 1839 the average percentage of deaths to cases of fever treated was 3.66, in 1856 it was only one per cent in a body of 18,000 men scattered from Peshawur to Pegu... (Anon, 1862a:12).

The resolution passed by Sir W. Denison in January 1863 was to plant 150 acres annually for at least ten years.[258] By March the number of cinchona orders had risen to eighteen, for a total of 44,000 plants, and McIvor was of the opinion that, "When it is remembered that no public advertisement has been made of the intention of the Government to dispose of the plants, this fact clearly establishes that Chinchona cultivation will be extensively taken up by private enterprise."[259] Work on preparing the land and planting out was now progressing at pace as McIvor relayed to William Hooker in April 1863 shortly after publishing *Notes on the Propagation and Cultivation of the Medicinal Cinchona or Peruvian Bark Trees*,[260]

> The progress the plants have made in the plantations is wonderful and there can be no doubt then chinchona is secured to India... Of its future prospects, we have now 500 acres more or less prepared and 80 acres planted out with 9 of the best varieties of chinchona.[261]

McIvor intended his manual to be an introduction to the management of the plants in their first stages of growth, for distribution to cultivators. Work also began on three new government plantation sites during 1863 (see chapter 6), and results from the first chemical analyses of Nilgiri bark had already been relayed to the British public:

> Specimens of bark of only two years' growth have been forwarded from the Neilgherry hills, and analysed by Mr Howard with most satisfactory results. He obtained crystallizations of very white sulphate of quinine, as well as chinchonidine and chinchonine, and the percentage product of alkaloids is as great as would be met with in South America (Markham, 1863:5).

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258 Secretary of State for India to His Excellency the Honorable the Governor in Council, dated 2nd January 1863. BPP, 1863:254.
259 AAR, 1863-64. BPP, 1866:4.
260 See McIvor, 1863. McIvor enclosed a copy of his manual with his letter to Hooker.
261 McIvor to Sir William Hooker, dated Ootacamund 25th April 1863. RBGK. DC Vol 57.f.109.

Early cultivators experienced mixed success, as the annual report for 1863-4 relayed.[262] Successes had also been reported from the North-West Provinces, Bombay and the Wynaad. However, the following year, progress in private planting slowed and many applications (to the extent of upwards of 50,000 plants), had to be relinquished, "in consequence of the applicants being unable to procure the land they had selected, being informed that it was reserved."[263]

For the first time, difficulties were also being experienced in procuring efficient men to work the plantations.[264] With no improvement in sight, on the 8th July 1864 McIvor applied to Government for 500 convicts to work on the government estates. A year later, the application had been sanctioned, and three buildings (one at each of the main plantation sites) to be used temporarily as a jails and ultimately as bark stores and drying houses, were almost complete.[265] The first convicts arrived in the autumn of 1865.

Private cinchona planting was once again soon following an upward trend. "Mr. Money, a gentleman from Bengal, having procured no less than 900 acres of land in the Dev[a] Sholah and its neighbourhood to be devoted entirely to chinchona cultivation."[266] Muraleedheran recognises this period (1860-65) as the first phase of the experiment when, "... the government was keen to demonstrate the commercial viability of cinchona cultivation to induce growth of private plantations" (2000:32). Dobson (1998) explains that *Cinchona succirubra*, the species which dominated the Indian plantations, was the most easily transportable species of the genus, a characteristic which meant that, "Between 1860 and 1865, nearly one million trees had been distributed among private planters" (Duran-Reynals, 1947:181). By 1866 there were around 30 cinchona plantations on the Nilgiris,[267] and by 1870 the government target of planting 1,200 acres with cinchona had been reached (figure 5.10).

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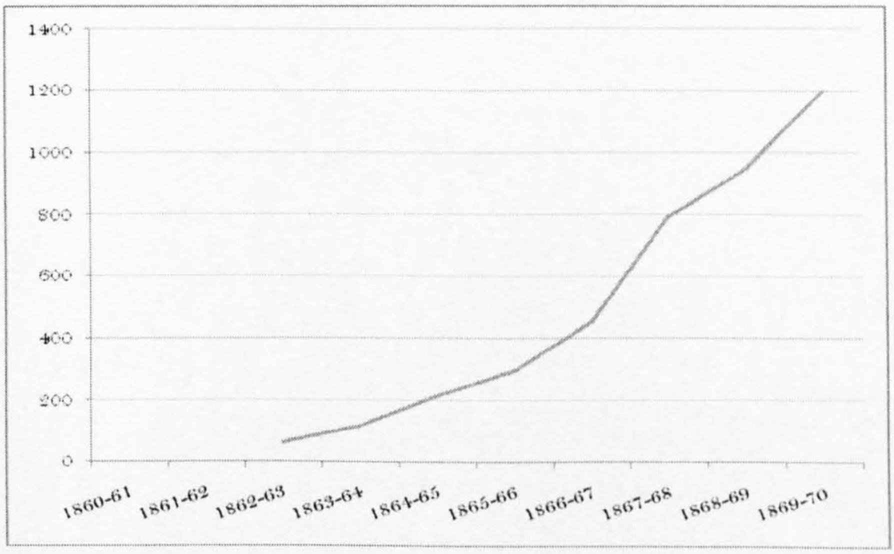
262 AAR, 1863-64. BPP, 1866:102.
263 AAR, 1863-64. BPP, 1866:103.
264 A more detailed examination of the labour force on the government plantations is provided in chapter 7.
265 Order of the Madras Government, dated 27th September 1865. BPP, 1866:179.
266 AAR, 1864-65. BPP, 1866:164. Sutton (2009) uses the example of the Deva Shola to illustrate how planters could get round orders prohibiting the felling of indigenous forest.
267 Map of the Neilgherries: Koondahs, and Wynaad to illustrate the progress of chinchona cultivation up to July 1866. BLO. Maps. D10:25(10).

The construction of better roads to the plantations had now become a priority, to enable the conveyance of both the plantation produce and supplies for the maintenance of the growing number of men employed on the plantations.[268] McIvor was now occupied in experiments in harvesting the bark from the trees (chapter 6), the South American system of uprooting the tree appearing unnecessarily ruinous.

Figure 5.8 - Total Acreage of Cinchona Planted out on the Nilgiris in Government Plantations, from Commencement to 1870



Source: Data taken from AARs.

5.3.2 Alkaloid Experiments

Chemical analysis of Nilgiri bark had already provided essential information for both McIvor and the private planters, and in 1866 it was decided that the time had now arrived for a Quinologist to be appointed on site at Ootacamund to support and advance, (rather than replace) the analyses performed in London by Howard. The isolation of the quinine alkaloid had created a new occupation as, "A new type of scientist appeared, equally able to handle botanical and chemical data: the quinologist."[269] John Broughton, by training an analytical chemist, was the man subsequently appointed, "to investigate on the spot various points connected with the cultivation of the tree, and the extraction and use of its alkaloids" (Anon, 1867b:6).

[268] Minute by Sir William Denison, 30th October 1865. BPP, 1866:187.
[269] http://www.kew.org/collections/ecbot/collections/topic/cinchona/a-short-history-of-cinchona/index.html [Accessed 16/01/10].

In 1867, three cases of cinchona bark (each containing around 100lbs of bark) were entered into the London auction after being subjected to analysis by Howard. The bark in two of the cases sold at 2s per lb; and that containing quill bark at 1s 9d per lb, considered a very satisfactory result of the "first offer of East Indian bark for public sale, in the London market."[270]

Figure 5.9 - Nilgiri Bark Destined for the London Auction, May 1869

Source: RBGK. Catalogue No. 52923. Photo: author. The text reads "Pale Bark from India some of the first imported, from Heason, Squire & Francis".

As Goss explains, "It would be the market, especially the Amsterdam and London quinine markets, which would decide the ultimate success of Van Gorkom's [and similarly McIvor's] ventures" (2004:110). Nilgiri bark performed well in its first year at auction, realizing very satisfactory prices, ranging higher than those obtained for the same description of American bark.[271] The following account of the bark auction comes from 1883.

> In London, bark is sold by public auction every alternate Tuesday, at one o'clock, at Messrs Lewis and Peat's offices, No 6, Mincing Lane. Samples are on show a day or two before the sales, at the sale rooms of the different brokers. Samples of each parcel of bark are sent round to the different buyers, some ten days previous to the sale for the purpose of testing its value by analysis...The buyers of the bark (there are about ten or twelve only in the London market) are divided into two sections, viz: those who buy for the druggists, and those who buy for the manufacturers of quinine, the last named being by far the most important. The 'druggists' buy entirely on appearance, hence a fictitious price is often obtained for a good

[270] Secretary of State for India to the Government of Madras, dated 23rd August 1867. BPP, 1870:121.
[271] It has not been possible to collate exact figures for the prices achieved for Nilgiri bark over the course of the study period, but a very clear sense of the ups and downs which cinchona planters had to manage is, I hope apparent from the remainder of the account.

looking bark, which would show a poor analysis... The market in Paris takes the next place in importance... (Hamilton, 1883:57).

The druggist buyers disposed of their bark in small lots among chemists on the continent who used it for producing tinctures and tonics. In contrast, the quinine manufacturers bought entirely on the results of chemical analysis. Of 16 known manufactories of quinine in the world, there were two in London (Howard's and Whiffen's), two in Philadelphia, one in Milan, one in Genoa, five in Germany, four in Paris and one in Amsterdam (Hamilton, 1883:57). The transfer of cinchona to India, Java and other European colonies naturally had implications for the bark markets, "So long as the production of cinchona bark was limited to South America, London, Paris, Hamburg and New York were the principal markets" (Imperial Institute, 1918:371-372). Once bark was cultivated in India, Ceylon and Java, "the market was gradually transferred. The Indian and Ceylon Barks were marketed in London; the Java bark found its way to Amsterdam" (Imperial Institute, 1918:372). The first auction of cinchona bark in Amsterdam took place in 1870 (Anon, 1904:810-811). The New York market lost its significance after the abolition of the duties on quinine (imports of bark having been replaced by imports of quinine salts) (Hamilton, 1883:57).

Although Howard's recent analyses had showed the Nilgiri barks to be rich in overall alkaloid content, most contained relatively low percentages of the preferred quinine, and higher levels of the alkaloids chinchonidine and chinchonine, "...commercially, but not medicinally, a disadvantage."[272] This immediately became an area of concern and, with a view to proving and popularising the efficacy of the other alkaloids, in 1867 the government appointed a commission of medical officers, in addition to Broughton, who were tasked with conducting inquiries into the matter (see Anon, 1867b:6). The results, "...showed that these other alkaloids were as effective as quinine as antimalarials. The British remained therefore satisfied with their already established plantations of succirubra and officinalis that grew well in the local climate and concentrated on the preparation of a 'febrifuge' that was a mixture of alkaloids..." (Gramiccia, 1987:11-12). This decision was a significant one, and one which aligned the whole project perfectly to the philanthropic mission outlined at the outset by Markham. Government officers were also now being

[272] Sir Charles Wood to the Government of Madras, dated India Office, 30th September 1865. BPP, 1866:133.

instructed to actively promote the cultivation of the tree by villagers and small holders of land, in order to make the tree's benefits as accessible to the poorest as possible (Anon, 1867:6).

The Nilgiri plantations now covered an aggregate area of 1,200 acres (the amount originally fixed as the limit) divided into four plantation sites, Dodabetta (375 acres), Naduvattam (450 acres), Pykara (comprising the Wood and Hooker plantations totaling 300 acres), and Mailkoondah (75 acres).[273] But, in the face of a decreasing budget, it was decided that if a buyer could be found, then Pykara and Mailkoondah (deemed the least important of the plantations) would be sold. No acceptable offer came forward. Private speculations, excepting a few large estates, were now also almost unsaleable.[274] Further budget cuts were introduced in 1871-72 in spite of protest from McIvor.[275]

In spite of these struggles, speculation regarding the fortunes to be made from investing in Indian cinchona continued to grow back home. From 1871 regular consignments of Nilgiri bark were sent to the auctions in London. Although restricted by the weather and the availability of labour, planters attempted to time their shipments of bark with favourable auction price forecasts, and on occasion to release information concerning the attributes of the bark strategically in order to obtain the highest prices possible.[276] Exact import and export quantities of cinchona for the United Kingdom were (and remain) difficult to obtain, as bark had been duty-free since 1815. However, far from illustrating the impending extinction of the fever bark in South America predicted in 1859, the private planter Mr. Money's attempt to collate figures for the period 1841-71,[277] clearly showed that South American bark supplies were far from exhausted. Howard explained to Markham:

> The vast supply from the Pitayo districts, now nearly exhausted, intervened and the far richer Columbian treasures especially in the Calisaya of Santa Fe have entirely altered the state of

[273] Government of Madras to the Secretary of State for India, dated February 7th 1871. BPP, 1875:1.
[274] AAR, 1869-70. BPP, 1875:5.
[275] AAR, 1872-73. BPP, 1875:113.
[276] Government Quinologist, to the Secretary to Government, 3rd August 1871. BPP, 1875:44.
[277] AAR, 1871-72. BPP, 1875:80.

> the case. The forests of Soft Bark of various descriptions are said to reach the frontiers of Brazil and are perhaps practically inexhaustible.[278]

These were not the market conditions that the Indian grown cinchona had been expected to enter, and a new strategy was needed to deal with the unexpectedly competitive auctions. *The Times* surmised on the 29th April 1872, that it was unlikely that India could compete with America in the cheaper kinds of bark, but that with the recent results of *renewed* bark, "India would defy competition, for no such bark, it appears, could be obtained from America" (Anon, 1872b:5). The British needed to carve out a niche for their bark, particularly as Howard had noted, that South America was no longer their only competitor. "The Dutch plantations in Java... seem likely to surpass greatly those in British India, and that specially in the production of material for the extraction of Sulphate of Quinine."[279]

Broughton's own preparation of 'Amorphous Quinine' (named so because it consisted of the alkaloids, mixed as they naturally occurred in the plant, precipitated from solution in an uncrystallised but tolerably pure state) had now been declared highly efficacious, and in 1870 manufacture had begun on a larger scale in a small manufactory erected near the Government Gardens. Receiving around 2,000lbs of fresh bark for its manufacture every week,[280] Broughton was soon supplying the medical stores. The following year, McIvor's proposal to convert the now disused jail at Naduvattam into "a suitable place for the manufacture of 'amorphous quinine'" was authorized.[281]

The majority of bark continued to be shipped to London, as presence in the auction was essential to establishing a positive reputation of Nilgiri bark in the wider world. The total income from the plantations in 1873 was a very satisfactory 13,490*l*, a figure that according to the Secretary of State, "entirely removes Chinchona cultivation from the category of experiments."[282]

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278 Howard to Markham, dated February[?] 12th 1873. RBGK. JEH/1/12. Insiders in South America were a valuable source of information on the intricacies of the bark trade as Robert Cross explained to Howard in a letter of October 24th 1872, "I work bark now more extensively, and having to deal with this article personally if I may say so for the purpose of commerce has been a good thing for me in one way; for I have found out a number of things which years of travel might never have revealed. RBGK. JEH/1/16.
279 Howard to Markham, dated February[?] 12th 1873. RBGK. JEH/1/12.
280 AAR, 1869-70. BPP, 1875:4.
281 Order of the Madras Government, dated 7th February 1871. BPP, 1875:24.
282 Secretary of State for India to the Government of Madras, dated 16th December 1873. BPP, 1875:128.

When government concluded in 1874 that Broughton's Amorphous Quinine was being produced at a considerable loss, and had recently been "varying in composition,"[283] they ordered its manufacture to be abandoned. This disappointment combined with the growing intensity of his argument with McIvor over the relative methods of coppicing (Broughton's preferred method of harvesting) versus mossing (McIvor's preference), prompted Broughton to immediately resign and then disappear without explanation in 1874. "It was feared that he had been made away with,"[284] but he eventually turned up in New Zealand in March 1881.[285]

McIvor died unexpectedly in 1876, leaving the Nilgiri plantations, and the South Indian cinchona industry without a Superintendent. The following year the testing times continued when famine struck southern India. However, unusually high bark prices were achieved at the London auctions in 1877 as a result of unrest in South America (particularly the civil war in New Grenada), which was preventing the exportation of South American bark. As Steere later observed, "The end of the [civil] war precipitated the final collapse of the highly speculative and uncertain business of exploiting wild species of Cinchona. The production of mediocre but dependable grades of plantation bark by the British in Ceylon and India gave the real death-blow to the South American industry..." (1945:116). At the London bark sales held in January 1877, renewed crown bark from the Nilgiris emerged as 'king' selling at 9s 1d per lb, the highest price realised for cinchona bark on record.[286] This was a short-lived record as the Planter's Sheet of the 25th April 1877 relayed:

> The latest price current makes the astounding announcement, that three cases of *renewed* bark from the Government Plantations on the Neilgherries realized the extreme price of 14s 1d per pound... The news is enough to unsettle the minds of the planting community, and to add to the furore for Cinchona cultivation which has characterised the past year and is still at its height.[287]

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[283] Government of Madras to the Secretary of State for India, dated Ootacamund, 9th March 1875. BPP, 1875:145.
[284] BL. *SIO.* 8th October 1879. p.6, col. A.
[285] BL. *SIO.* 19th March 1881. p.8 col. C.
[286] BL. *SIO.* 7th March 1877. p.5.
[287] BL. *SIO.* 25th April 1877. p.5.

The high prices were a direct result of the unrest in South America,[288] and fellow planter Mr. Money pictured a gloomy future for Nilgiri bark growers:

> ...Such prices [those achieved at the latest sales] are mainly due to the present abnormal state of the bark market, and are as such as cannot be expected in future. The following is an extract I received this mail from the bark dealers in London dated 6th April 1877, 'In consequence of the War or Revolution in Columbia (South America) we have no arrivals of bark and prices are higher. We expect that there will be quite a rush for the Government bark next Tuesday and Tuesday fortnight, for we are full of orders on all sorts and high limits. If however there comes a telegram from Columbia that war has ceased, all orders are cancelled...'[289]

Money speculated that once bark peelers reached forests in other South American districts, or the Columbian war ceased, normal exports would resume, or increase, leaving many millions of pounds of unsold stock in Europe, weighing down the market for years, unless the current Russian and Turkish War continued for a long time. Howard's had now raised the price of their quinine by 2.9 per ounce, and cinchona planters were rumoured to be getting rich quick:

> ... Already dame rumour credits a gentleman largely interested in cinchona in this district with having netted Rs 300,000 by the sale of bark. It is needless to say that dame rumour is as usual quite wrong and that nobody has been more astonished that the person most concerned in the matter on hearing of the wonderfully good luck that has happened upon him. All the same, though profits on cinchona will certainly not amount to lakhs of rupees, there is no doubt that the value of bark is sure to go up.[290]

Labour was also currently plentiful and cheap, aiding the fortunes of the Nilgiri planters. Yet, as General Morgan pointed out, "It is not every capitalist who can afford to wait ten years for any return for his money."[291] The number of suitable and available sites was also restricted, and the bark prices far from stable. Nevertheless the *SIO* noted in May that "everybody is going in for this cultivation,"[292] and the Nilgiri Tea and Cinchona Company registered for business during the year. As the price of quinine continued to rise, the *Darjeeling News* urged those who employed large numbers of labourers in malarious districts that they

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288 BL. *SIO*. 9th May 1877. p.2.
289 BL. *SIO*. 2nd May 1877. p.2.
290 BL. *SIO*. 9th May 1877. p.6
291 BL. *SIO*. 12th May1877. p.2.
292 BL. *SIO*. 23rd May 1877. p.5.

would do well to switch to febrifuge to protect them,[293] and even in England the high cost of quinine was said to be leading doctors to become somewhat shy of using it.[294]

Prices for cinchona estates were also at a high. Demand for plants and seed from the Government Gardens had in accordance increased, with 342 ounces of seed distributed to planters on the Nilgiris and the Wynaad during the half year ending 31st July 1877, an amount which exceeded one half of the total quantity issued to the public since the project's commencement.[295] However, numbers of cinchona estates remained small; of a total of 165 estates listed on the Nilgiris in 1877, only 17 were cultivating cinchona, and only seven as a single crop. Looking at these seven alone, cinchona cultivation covered 972 acres or 6.7 percent of the cultivated land area of the Nilgiris (Anon, 1877). Seemingly the most successful of the cinchona company ventures, the Nilgiri Tea and Cinchona Company was offering its own plants for sale only a year after its formation,[296] and had become the largest private owner of cinchona land, having now purchased the Deva Shola, Welbeck and Kartary estates (Anon, 1878b). Mr. Money, the previous owner of the Deva Shola having become a shareholder in the new company.

The civil war in New Grenada ceased in June 1877, and bark sales were immediately rendered dull, "buyers being afraid to operate in the face of expected large arrivals from that quarter."[297] But as Howard explained, it would take some time for the markets to return to normal.

> The interruption of the import trade during the war, and the failure of many houses, destroyed the means to pay for the bark. Many of the bark collectors [in South America] have perished; and the small passes and paths to bring the bark from the forests, have more or less been destroyed by the tropical vegetation, and must be opened again (Howard, 1877:207).

Contributions arriving from the British and Dutch possessions had successfully prevented a dearth of supply from becoming a famine. But, when shipments from

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293 Reproduced in BL. *SIO.* 13th June 1877. p.5.
294 Howard, 1877: 207-210.
295 BL. *SIO.* 6th February 1878. p.5. col. B.
296 BL. *SIO.* 27th March 1878. p.1, col. C.
297 Bark auction report reprinted from the Ceylon Observer in BL. *SIO.* 20th June1877. p.5.

South America resumed on the 3rd October, a fall in the price of cinchona bark was reported,[298] the price of Howard's quinine also falling during the month.[299]

Fears immediately began to grow that the recent proliferation of cinchona estates would in time lead to an increasingly flooded market and diminished returns. Planters were also making rapid progress in Ceylon,[300] and their trees were nearing productive age.

Government officials and employees involved in the state cinchona experiment also often invested privately in cinchona, despite the practice being officially discouraged. Sir W. Denison (Governor of Madras 1861-66), and other members of the Denison family held cinchona investments on the hills, and McIvor also invested in private cinchona. Upon his death in 1876; his wife Anne had inherited his shareholding in the Ossington cinchona estate. In 1880 she wrote to Howard demonstrating her continued interest in the enterprise and the recent success achieved at Ossington. "We have had a fine season...Mr. Shell[?] has a famous crop at Ossington. This is a great thing for me, as I am the largest shareholder in the Estate. I see by the reports that the price of Quinine is still keeping up."[301] Ossington bark had recently obtained excellent prices, *Cinchona condaminea* reaching 8/2 per lb. Anne commented, "Cross tells me that he had never seen anything in S.America to equal our Red Barks at Neddivuttum, he said they were 'simply splendid.'"[302]

The appeal of the cinchona endured into the 1880s, even when gold prospecting was taking the Nilgiris by storm. The *SIO* reported,

> During a recent visit through 'the Valley' portion of South-east Wynaad, we heard more about extensive cinchona nurseries and the large number of C. Succirubras planted out last year, and the season now closing, than we did of gold reefs. In our opinion those Companies who hold some good estates, with coffee and cinchona – to fall back upon just when the out turn of gold runs low, will be the best for shareholders.[303]

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298 BL. *SIO.* 3rd October1877. p.5.
299 BL. *SIO.*10th October 1877. p.4.
300 BL. *SIO.*16th January 1878. p.6, col C.
301 Anne McIvor to Howard, dated 3rd August 1880. RBGK. JEH/1/44.
302 Anne McIvor to Howard, dated 1st February 1881. RBGK. JEH/1/44.
303 BL. *SIO.* 6th November 1880. p.6, col. A-B. Also see, *SIO.* 3rd September 1881. p. 7, col. B.

Speculations surrounding the presence of gold in the district soon proved to be unfounded. The Nilgiri Gold and Cinchona Company, registered for business on the 19th May 1881 was dissolved on the 6th October 1882 after failing to carry out any business.[304]

5.4 Neglect and Falling Prices (*c.* 1878-1883)

Captain Campbell Walker was, in January 1878, the latest individual appointed to inspect and report upon the condition of the cinchona plantations, the prevalent opinion being that, "these valuable plantations have not at all been cared for latterly."[305] His comprehensive survey revealed that instead of the supposed 1,190,458 plants in the Nilgiri government plantations, there were in fact only 569,031.[306] In addition, labour shortages were once again beginning to be felt, sickness had broken out, claiming a large number, and others had left through fear. In the wet months of 1878 the roads to the plantations became impassable, preventing grain reaching the labourers.[307] Government subsequently announced the final extinction of the Mailkoondah plantation. Commenced in 1865, "It soon became apparent that the site was too remote to be efficiently superintended...The plantation is now to be rooted up or 'grubbed up' as the Order more *euphoniously* styles it; the bark sent to England for sale and the site 're-transferred' to its existence [as a reserved forest]"[308].

However, reports from the London market in July 1879 were pleasing:

> The last invoice of Cinchona from the Government Estates of Neddiwuttum, Pykarrah, and Dodabetta in this Presidency, which consisted of 486 bales... have sold very favourably in England, the net sales amounting to £8,619-6-3. These have been the best sales yet effected and they are due to the very superior quality of the cinchona from the first two estates.[309]

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[304] TNA. BT 31/2809/15386.
[305] BL. *SIO.* 23rd January1878. p.3, col. C.
[306] Revenue Reports. Barlow (Commissioner) to Master (Secretary to Government), 5th October 1878. p.1. MRMC, 1861-85.
[307] *Ibid.* p. 4.
[308] BL. *SIO.* 14th May 1879. p.5, col. C.
[309] BL. *SIO.* 16th July 1879. p.8, col. A.

The present value of the plantations, according to calculations by the Commissioner, was, "at least three lakhs of rupees", estimated to be worth, "£500,000 sterling."[310]

Entering the 1880s, thoughts were drifting towards shaking up the system of manufacture. The *SIO* explained, "What the planters want is that the manufacture of the quinine and alkaloid should no longer be kept in the hands of a few manufacturers in the world."[311] The Nilgiri plantations were now beginning to fall behind newer ventures. Bark from Jamaica had entered the London market in September 1879 fetching 2s 10d per lb, more than was reached by East Indian or Ceylon bark at the same auction (Anon, 1879), and the acreage of cinchona in Ceylon had overtaken the extent of South Indian cultivation. When Colonel Beddome travelled to Ceylon in October 1881 the *SIO* asked rhetorically, "Is the Madras Government actually seeking information from the planters of the Island, who have only, within the last three or four years, turned their attention to cinchona, while the cultivation has been carried on for 20 years under their own auspices?"[312] Not all the planters would be able to survive the decade (Evans, 1941:115).

McIvor had still not been replaced, and the charge of the government plantations had now passed through a chain of District Commissioners,

> The many changes that take place in the personnel of our district government cannot but in the long run prove injurious to a department that requires the constant and zealous direction of a specially taught man. All our Commissioners cannot be skilled agriculturalists and quinologists... At present, Madras, instead of leading the way, is waiting on Bengal and Java.[313]

Control of the plantations passed to the Forest Department in 1881.

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310 Revenue Reports. Roupell (Acting Commissioner) to Secretary to Government, dated 25th September 1880. p.19. RBGK. MRMC, 1861-85.
311 BL. *SIO*. 14th February 1880. p.11, col. D. The *Madras Mail* later voiced its belief that the current small ring or syndicate of manufacturers was the cause of the present low bark prices, reproduced in *SIO*. 19th January 1884. p. 8, col.A-B.
312 BL. *SIO*. 1st October 1881. p.5, col.C.
313 BL. *SIO*. 6th September 1879. p.5-6.

In December of the same year, Cross delivered a revelation that the trees believed to be *Cinchona succirubra* at Naduvattam, were actually all *Cinchona micrantha.* Government immediately deputed George Bidie (Superintendent of the Government Museum at Madras) to investigate the accusations. Bidie concluded that Cross was mistaken, but Cross was adamant he was right, writing to Markham, "...the most stupendous mistake that has ever occurred in this history of planting has been committed...The affair has raised a lot of ill wind against me some saying that I have 'depreciated estates' &c."[314] The truth of the accusation was never really determined, the opinion being that in the end, so long as the bark was selling, it did not really matter what it was called.

In a dramatic shift in strategy, on the 10th January 1882, the first auction of government bark was held in Madras. 10,000 lbs of bark (crown and red), in lots of about 100lbs each were offered and all sold.[315] Ceylon planters were also now finding local auction sales of bark (in Colombo) a convenient means of disposing of their produce. The *SIO* highlighted the advantages:

> The principal buyers are Italian and American merchants, and the sales are by analysis of samples made on the spot, the price generally running one shilling per cent of alkaloid... In addition to a fair price, sellers by this method avoid the uncertainty and delay of a distant market. Of course London and Continental brokers are not in favour of sales either in India or Ceylon, but the experiment has already proved successful, and these local sales are likely to increase in extent.[316]

Rumours soon began to circulate that the Nilgiri cinchona planters were contemplating petitioning the government to abstain from selling any bulk of bark in the open market in future, believing it tended to depress private enterprise. With a small number of exceptions the government owned Nilgiri cinchona plantations were fast becoming regarded as, "but a wreck of what was once profoundly designated 'Noble and magnificent Forests of Cinchona.'"[317]

In May 1882 Professor Marmaduke Lawson, Professor of Botany at Oxford was offered the Superintendent position and accepted, taking charge in June of the

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314 Cross to Markham, dated 21st January 1882. MRMC, 1860-97.
315 BL. *SIO.* 17th December 1881. p.1 col. A.
316 BL. *SIO.* 6th May 1882. p.7, col.C.
317 BL. *SIO.* 23rd September 1882. p. 8, col.C-D.

following year, when he began to renovate the Hooker and Wood estates, and undertake experiments in a rotation system of coppicing.[318] When Henry Trimen (of the Ceylon botanical garden) was asked to report on the current state of the Nilgiri estates in 1883, he appealed for the necessity of a Quinologist on site to take up the work which had stopped eight years ago upon the sudden resignation and disappearance of Mr. Broughton, and for all of the records regarding cinchona cultivation on the Nilgiris to be brought together and made available for reference (Trimen, 1883).

Hamilton's[319] *Notes and Statistics of Cinchona Bark,* published in the same year hinted that the financial success of Nilgiri Cinchona planters would not last much longer.

> The imports into the United Kingdom [in 1882] amounted to 15,599,920 lbs, against 14,040,096 lbs in the previous year. Bark shows in this year a slight fall in the average value, amounting to 1½d per lb., all round, partly attributable in my opinion to the importation of an excessive quantity of inferior bark, such as twigs, sweepings, and dust, which, previously, were considered of no particular value. The total value for the imports for 1882, although upwards of one and a half million lbs. more were imported, shows a diminution of £24,281 (Hamilton, 1883:6).

More than two-thirds of the bark imported in this year from the East Indies had come from Ceylon where the cinchona industry had received a further impetus when the coffee industry was ruined by the attack of leaf disease (Imperial Institute, 1918, Duncan 2007, Webb, 2002). The government plantations in India now comprised a total of 3,282 acres, situated as follows: Darjeeling 2,344 acres, Madras Presidency 888 acres, and Burma 50 acres. However the private acreage of cinchona had exploded in the Nilgiris, "The private plantations in Darjeeling comprise some 1800 acres, and in the Madras presidency some 5000 or 6000 acres" (Hamilton, 1883:42).

The 1880s signalled the start of the cinchona boom in Java. "Entrepreneurs flocked to West Java to ride the Cinchona wave. Whereas in 1880 only 124,000 kilograms of Java Cinchona bark were auctioned in Amsterdam (most of it coming from government plantations), in ten years time this multiplied twenty fold, to 2,901,000

[318] Lawson to Hooker, dated 10th November 1884. RBGK. MRMC, 1860-97.
[319] Fellow of the Statistical Society of London.

kilograms in 1890..." (Goss, 2004:114). The fear that production would soon exceed demand soon became very real. However some including Von Gorkom (Superintendent of the Java plantations) remained convinced that world demand was potentially limitless, and would remain so even if an artificial version of quinine was created. "The possibility of an artificial preparation of quinine may rise up before the planters as a threatening spectre, but we continue convinced, that the cultivation of cinchona thereby would in no way receive a death blow" (Von Gorkom in Hamilton, 1883:60).

In September 1882 a proposal arrived at Kew from Lieutenant Colonel Henderson (a cinchona planter, member of the Indian Consolidated Gold Mining Company Limited, and resident of S.E. Wynaad),[320] to establish on the Nilgiri Plateau, a manufactory of sulphate of quinine and the various other alkaloids.

> ...we [Henderson and several influential men in London] believe that it is not only a feasible but would prove a profitable and valuable business. The enormous (I can use no other word) expenses incurred in drying, packing and sending the bark down to the coast...Would all be avoided...The secret of manufacture has ceased to exist and we can secure one or two men who are competent to the task and able to analyse critically.[321]

Henderson's proposal was eventually rejected. During 1882, the government had however undertaken an experiment involving working the bark into alkaloid before sale. A "further profit of £1487-17-10 was secured,"[322] providing support for the resumption of alkaloid manufacture on the Nilgiris (see below). However, by the autumn of 1883, the status of the market was causing considerable anxiety to planters, "A steady decline has set in during the last few years until we see now under the head of 'East India, Red' from Rucker and Bencrafts, circular of August 16th 'Twigs' ½d to 10d."[323] From 1882 cinchona planters received slight assistance from government in the form of an exemption for land tax.[324] Producing lower cost forms of quinine was now seen to be the best method of increasing demand for bark and concurrently improving the fortunes of the Nilgiri cinchona planters. In May

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[320] Henderson to Hooker, dated 26th December 1882. RBGK. MRMC, 1860-97.
[321] Henderson to Hooker, dated 8th September 1882. RBGK. MRMC, 1860-97.
[322] BL. *SIO*. 15th July 1882. p. 7, col. C-D.
[323] BL. *SIO*. 15th September 1883. p.8, col. A-C.
[324] BL. *SIO*. 5th January 1884. p. 8, col. C-D, and also *SIO*. 3rd May 1884. p.7, col. D.

Cinchona ledgeriana bark from Java made its first appearance in the London market, not really fulfilling expectations achieving fewer than 3s per pound.[325]

On the 27th August 1884, the *SIO* reported, "We are very pleased to hear that a qualified quinologist is coming out for the plantations."[326] The new appointment Mr. Hooper was soon producing alkaloid and quinine sulphate on the largest scale yet seen on the hills.

The export from Ceylon for 1885-86 was estimated to be 10,000,000lbs depending upon the prices current. The *SIO* reminded its readers that in addition to the Ceylon situation, "...supplies from Java will be on an increasing scale, and that cultivated Bolivian barks will also make their appearance on the London market early in 1886."[327] In November 1885 members of the Wynaad Planters Association requested that the *Madras Mail* and *Madras Times* publish a fortnightly telegraphic quotation of the value in the London Market of the unit of quinine, and began to petition government to allow planters to get analyses performed at cost price by the government Quinologist.[328] The millions of plants put out within the last four or five years in the Wynaad would soon be ready to bark and popular opinion was that:

> ...useful as statistics would be to the whole body of cinchona growers, the authorities at the Neddiwuttum Government Gardens prefer to keep them from the light of day. They go on flooding the market with bark, caring – and from all accounts knowing – little whether the sales show a profit or a loss, but they steadily withhold information. Recent occurrences have shown that figures are not the strong point of the Director of the Government Gardens, & c...[329]

The continuation of bark auctions in Madras demonstrated to some the government's disregard for private planters.[330] However by April 1886, the London sales were going off with, "rather more spirit and good competition,"[331] and Hooper announced that government had now approved him to undertake analyses for

325 BL. *SIO.* 3rd May 1884. p.9 col. B.
326 BL. *SIO.* 27th August 1884. p.4, col.A-C.
327 BL. *SIO.* 19th December 1885. p.10, col.D.
328 BL. *SIO.* 21st November 1885. p. 10, col.B.
329 BL. *SIO.* 23rd January 1886. p.7, col.B-C.
330 BL. *SIO.* 13th February 1886. p.9, col.D. The local sales were first announced in BL. *SIO.* 1st August 1885. p.9, col. C.
331 Report of bark sales of 9th April reported in BL. *SIO.* 15th May 1886. p.10, col.D.

private parties, at a rate of Rs 20 for a complete analysis and Rs 15 for a partial analysis.[332] However the *SIO* had recently raised questions about the reliability of government analyses, "For instance at a recent sale, where our Government Quinologist and a London Analyst valued the bark of a certain estate on the Nilgiris at 3.51 and 3.86 per cent, respectively the buyers freely discounted the value at only 1.91 per cent."[333]

5.5 Factory Production (*c.* 1887-1900)

Hooper's new fluid extract (originally devised by De Vrij) was sent for trial in Upper Burma in September 1886, where it was administered to troops. When the opinions of the medical officers arrived, they were quite contradictory: some stating that as a therapeutic it was of little or no value; others that it may be used in mild cases of fever with advantage; and others, again, that it is in every respect equal to quinine.[334] In March 1887, a turbine and disintegrator for the factory arrived, and were put up in a building at Naduvattam, and connected with a tank. The grinding of the bark commenced in June, only to be halted for several months in July after a landslip broke down one of the walls, 61,650 lbs of bark having being powdered during the month.[335] Sulphate of quinine soon joined Hooper's list of manufactures, but bark was now accumulating in the stores on the Nilgiris, as yields were exceeding that required by the factory, but were no longer being sent to auction. Instead, small quantities were being sold directly to the Medical Stores Departments of both the Madras and Bombay Presidencies. Factory production of both febrifuge and quinine sulphate gave Nilgiri cinchona a boost, and the plantations remained a source of great pride for the region, often included in tourist guides like Nicholl's:

> The government cinchona plantations are situated on the hill sides which rise above the gardens, and to those who would wish to see how far success has resulted from an experiment to raise this South American tree in the climate of the Nilgiris, a visit to this spot with its extending acres of cinchona will well repay the trouble (Nicholl, 1888:8).

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[332] BL. *SIO*. 17th April 1886. p.1, col.C.
[333] BL. *SIO*. 6th March 1886. p.8, col.C.
[334] AAR, 1886-1887: RBGK. MRMC.
[335] AAR, 1887-1888. RBGK. MRMC.

In October 1889, *The Times* reported that three leading merchants of Colombo had addressed merchants and planters in Ceylon, proposing the formation of a Ceylon Cinchona Syndicate, with the purpose of receiving, pressing and storing cinchona in Colombo. "Ceylon at present practically controls the cinchona market, and it is hoped this year, in place of sending the estimated produce of eight million pounds, to send only five or six millions" (Anon, 1889:6). The following year a trade report published in the *Chemist and Druggist* showed that at the London auctions the amount of Ceylon bark sold was, "four times larger than the quantity of East Indian bark, and that the demand is great may be inferred from the fact that 92 per cent of the supply offered was sold" (Anon, 1890:933).

Stocks of bark were rapidly accumulating on the Nilgiris, far in excess of the quantities required by the factory. In 1890-91, 133,351 lbs of bark were harvested from the government plantations (figure 5.11) which, when added to the stock remaining in the *godowns* gave a total of 611,095 lbs. Storage room was now at a premium. In the next few years factory production increased, and gradually ate into the stocks of bark, as well as consuming some bark from local private estates. Indeed in 1897-98 the newly formed Cinchona Department (see below) purchased 108,934 lbs of bark[336] from private growers in view of the increasing demand for quinine and the inadequacy of the existing plantations to meet the requirements of the Medical Stores and other buyers, in addition to making small extensions to its own estates. This figure rose to 405,074 lbs of bark the following year, the factory producing around 10,000lbs of quinine sulphate per year, enough to meet all requirements.[337]

In 1890 packets of quinine sulphate began to be sold through District Collectors, but the scheme had a slow uptake, attributed to the unpleasant taste of the drug,[338] and the price (3 pies for a five grain packet), being too high. It was subsequently decided that the price should be reduced to 2 pies per powder, or one rupee for a packet containing 100 such powders, and that the name and directions for use should be printed on the wrappers in the vernacular language of the district to

[336] AAR, 1897-1898. RBGK. MRMC.
[337] AAR, 1898-1899. RBGK. MRMC.
[338] AAR, 1890-1891. RBGK. MRMC.

which the packets were sent. Sales increased only slowly over the next two years, and in August 1893 the measure of using Postal Department officers as an agency for their sale was approved by government.[339] 334,500 packets of quinine powders were distributed through their agency in 1883-1884.[340]

Figure 5.10 – Pure Quinine Sachet, India

Source: RBGK. Economic Botany Collection. Catalogue No. 64381. Photograph: author.

In 1895 it was decided that instead of being put up in open wrappers, the quinine powders for Post Office issue should be put up in closed envelopes (figure 5.10), in an attempt to guard against dishonesty.[341] From the commencement of the official year 1895-1896, local fund dispensaries and Municipal hospitals obtained quinine and other medicines independently of the Madras Medical Stores Department, instead applying directly to the Cinchona Department (see figure 5.14 for factory outputs).

After intimating his intention to retire shortly, Lawson died at Madras after an operation in February 1896.[342] Upon his death, the Cinchona and Botanical Departments were separated and Mr. W.M. Standen was appointed Director of the newly constituted Cinchona Department in May 1896. George King subsequently suggested that what remained of the Wood plantation at Pykara be abandoned, and a G.O. subsequently issued instruction for this to be carried out. "All the trees were cut down and uprooted, and the bark was harvested before the end of the year. A fire broke out in the estate in February and cleared the ground of the leaves and twigs of cinchona, and thus made the work of abandonment complete."[343]

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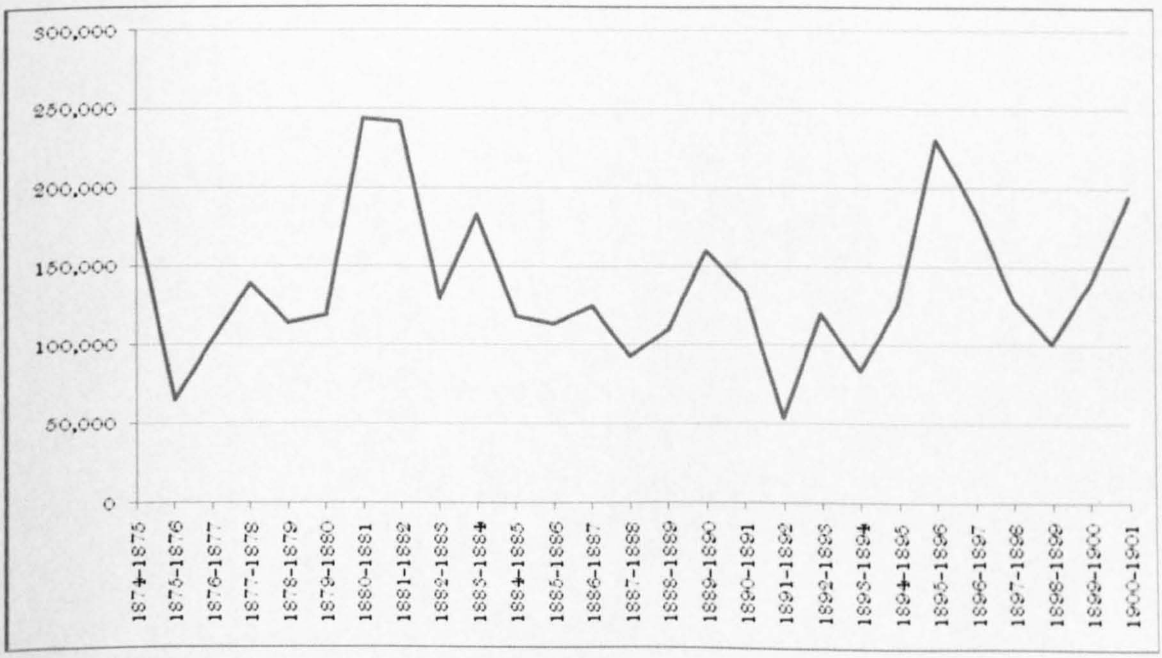
[339] List of the Proceedings of the Madras Government embodying reports on Botanical and Agricultural matters for transmission to Kew, dated 4th August 1893. RBGK. MRMC. 1860-97.
[340] AAR, 1893-1894. RBGK. MRMC.
[341] Kew authorities to Charles Bernard, India Office, dated 1st November 1895. MRMC, 1860-97.
[342] AAR, 1895-1896. RBGK. MRMC.
[343] *Ibid.* p.4.

The position of Quinologist was abolished in May 1897, and Hooper was placed at the disposal of the Government of India in the Revenue and Agricultural branch.[344] Postmasters were proving to be a successful agency for the sale of quinine to the poorest classes (figure 5.13), and by 1897 1,550 Post Offices throughout the Madras Presidency were serving as depots for the sale of quinine.[345] The Madras and Bombay Cinchona Departments now vied for lucrative contracts to supply the various local governments and administrations. The allocation made in January 1899, was a boost to the Nilgiri factory: "The Neddivattam factory will supply quinine to Madras, Bombay, North-West Provinces and Oudh, Central Provinces, Burma, Ajmere, Coorg, Berar and Mysore, while the Bengal factory will supply Bengal, Punjab and Assam."[346] However the stocks of febrifuge held were now so large that the prospects of disposing of it within India were thought to be very small. A price increase implemented in the previous year had checked the sales, and it was resultantly decided to return the price to 2 pies. In 1900 an entirely new and up-to-date quinine manufacturing plant was purchased.

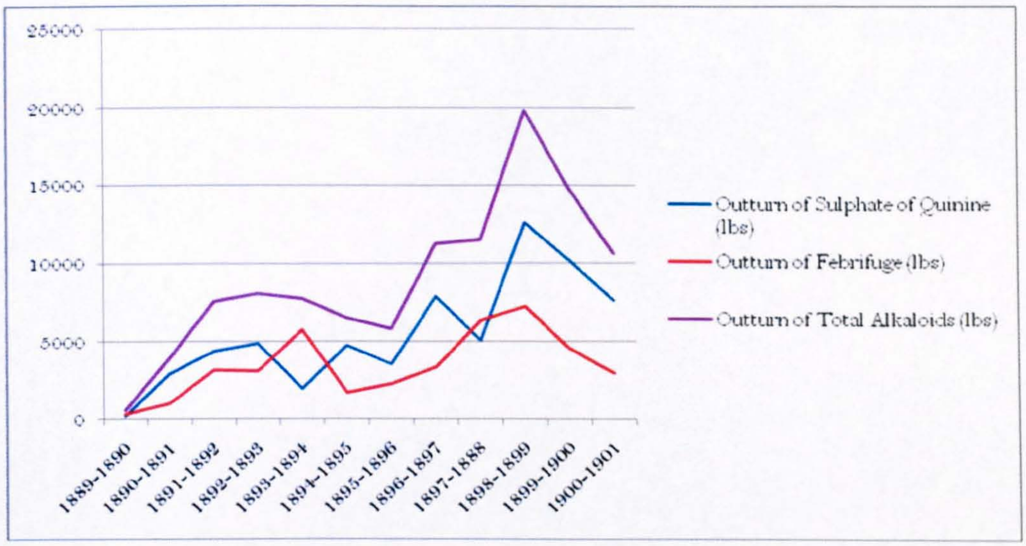
Figure 5.11 - Bark Harvested from Government Cinchona Plantations, Nilgiris, from Commencement to the Year 1900-1901 (lbs)



Source: Complied with data from AAR, 1900-1901:16. RBGL. MRMC.

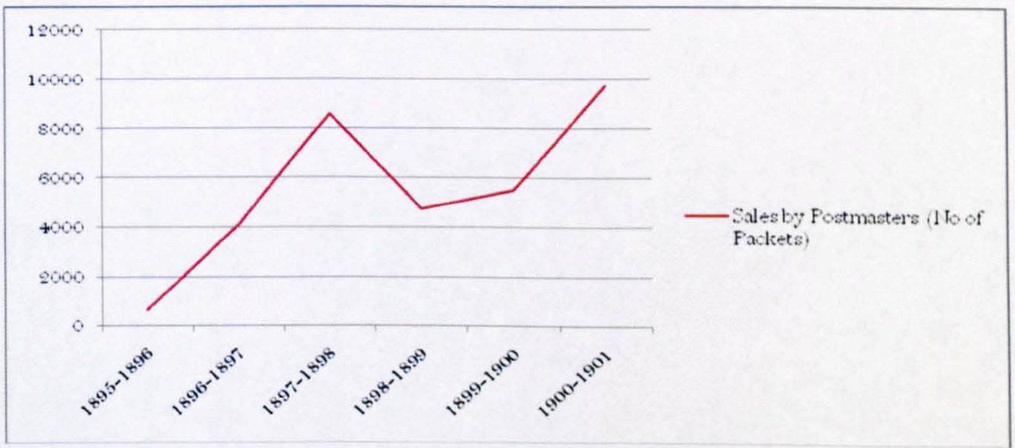
344 AAR, 1896-1897. RBGK. MRMC.
345 *Ibid.*
346 AAR, 1898-1899:9. RBGK. MRMC.

Figure 5.12 - Outturn of Alkaloids since the Commencement of Manufacture at Naduvattam



Source: Data taken from RBGK. AAR 1900-1901:11. RBGK. MRMC.

Figure 5.13 - Sales of Quinine Sulphate by Postmasters, 1895-1901



Source: Data taken from AAR 1900-1901:12. RBGK. MRMC. The large increase from 1899-1900 to 1900-1901 was attributed to the reduction in price of each five grain powder from 3 pies to 2 pies.

The most detailed account of manufacture at the factory comes from Davis:

> Three Carter's disintegrators are used for grinding the dried cinchona bark into powder. This powder is mixed with lime and water and is left 36 hours. It is then thrown into cylindrical steam jacketed vessels called digesters and stirred for 15 minutes with a certain percentage of caustic soda. Six hundred gallons of crude petroleum are then run in and stirring goes on till a temperature of 190°F is reached, when the steam is cut off and the stirring continues for another hour. The bark is treated in this manner three times, fresh charges of 600 gallons of oil being added each time. These three charges of Quinine bearing oil are now washed in dilute sulphuric acid. The sulphuric acid solution which now contains all the Alkaloids is run off from the bottom of a lead lined receptacle and is then pumped up to an upper room, for

> neutralisation with caustic soda. The crude quinine sulphate thus obtained, is run into ferro concrete troughs where it is allowed to crystallise for 48 hours, after which time the crude crystals are separated from the mother liquor by a centrifugal machine. The crude sulphate is now purified and run into ferro concrete troughs where it crystallises for 48 hours. These crystals are again purified by recrystallisation. The purified crystals are placed in trays in a drying room, and, when dried sufficiently, are packed into tins for despatch to the head office whence they are distributed to the various dispensaries, etc. The mother liquor yields 'cinchona febrifuge' (Davis, 1920:86).

5.6 Decline (*c.* 1897-1900)

Muraleedharan recognizes that in the 1880s and 1890s, "planters had strong incentives to abandon cinchona production in favor of other crops that ensured higher returns" placing "the government at the mercy of foreign markets for the supply of cinchona" (2000:94). At the same time, strong arguments developed in official circles advanced as to why private enterprise should not be relied upon for cinchona production (Muraleedharan, 2005). A *Complete List of Tea Companies and Tea Gardens: Also Indigo, Sugar, Lac, Cinchona and Coffee Manufactories in India and Ceylon* from 1894 names 34 cinchona estates within the Madras Presidency.

> At the end of the official year 1896-97 there were 5,916 acres of land under chinchona cultivation, of which about 72 percent was situated in Southern India, the remainder (nearly 28 per cent) being in Bengal...Most of the area in Southern India is in the Nilgiris and Malabar, there being 1,762 acres in the Nilgiris, 731 in Malabar, 1,402 in Travancore, 335 acres in Mysore, 8 in Coorg, and 42 in Madura.[347]

Nationally the picture was now one of a declining industry, "During the twelve years ending with 1896-97 the area under chinchona has fallen from 10,418 acres to 5,916 acres. There has been a substantial decline in Bengal as well as in Madras, and in Coorg the cultivation has been almost entirely abandoned."[348] During the same period the number of plants in permanent plantations had fallen from 17¼ million to 7½ million, as "planters who took up the cultivation some fifteen or twenty years ago in the hope of making large profits have been greatly disappointed, and in most cases the trees have been uprooted to make way for tea or

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[347] *Statistics of Chinchona Cultivation,* 1897:1. CUL. OP. 1150.633.04.
[348] *Ibid.*

coffee."[349] Even the famous and extensive Deva Shola estate was converted to tea in 1897, "This proved such a success that tea cultivation was taken up by many other properties, and the area under this product grew by leaps and bounds" (Davis, 1920:43).

5.7 Conclusion

The British cinchona experiment followed a number of other attempts by European powers to acclimatize the South American tree in European colonies. A complex plant, with a high number of easily confused species and varieties, each with varying alkaloid content, the cinchona took relatively well to the Nilgiri Hills of Southern India after early disappointments and attempts to undermine the authority of McIvor and Markham, and the government plantations were soon well stocked with trees. While their bark was found to be lacking in the quinine alkaloid, it did contain high levels of other alkaloids with febrifuge properties, and early deliveries to the London market achieved promising prices. Capitalists and planters were encouraged to invest in the cultivation of the new wonder crop, although very few succeeded in making fortunes. The government venture lacked a coherent strategy, and slowly production from Ceylon, and Java overtook Nilgiri bark in terms first of quantity and subsequently of quality. It was eventually decided that at least some proportion of the Nilgiri bark should be worked up on the spot, but it wasn't until the 1890s that factory production really got going under the leadership of Quinologist Hooper. Dramatic improvements in febrifuge distribution in India were achieved under the Post Office packet scheme. Unfortunately by this time both government and private cinchona estates had been neglected, many switching to the cultivation of tea.

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349 *Ibid.*

6 Situating the Cinchona Experiment

This chapter focuses on the experimental and scientific nature of the British cinchona project as it played out on the Nilgiris, both through the cultivation of cinchona and the production of quinine products. "To a growing number of colonial administrators, science promised to solve numerous problems of colonial power, foremost Europeans' expansion into tropical nature" (Goss, 2004:88).

6.1 Spaces of Colonial Science

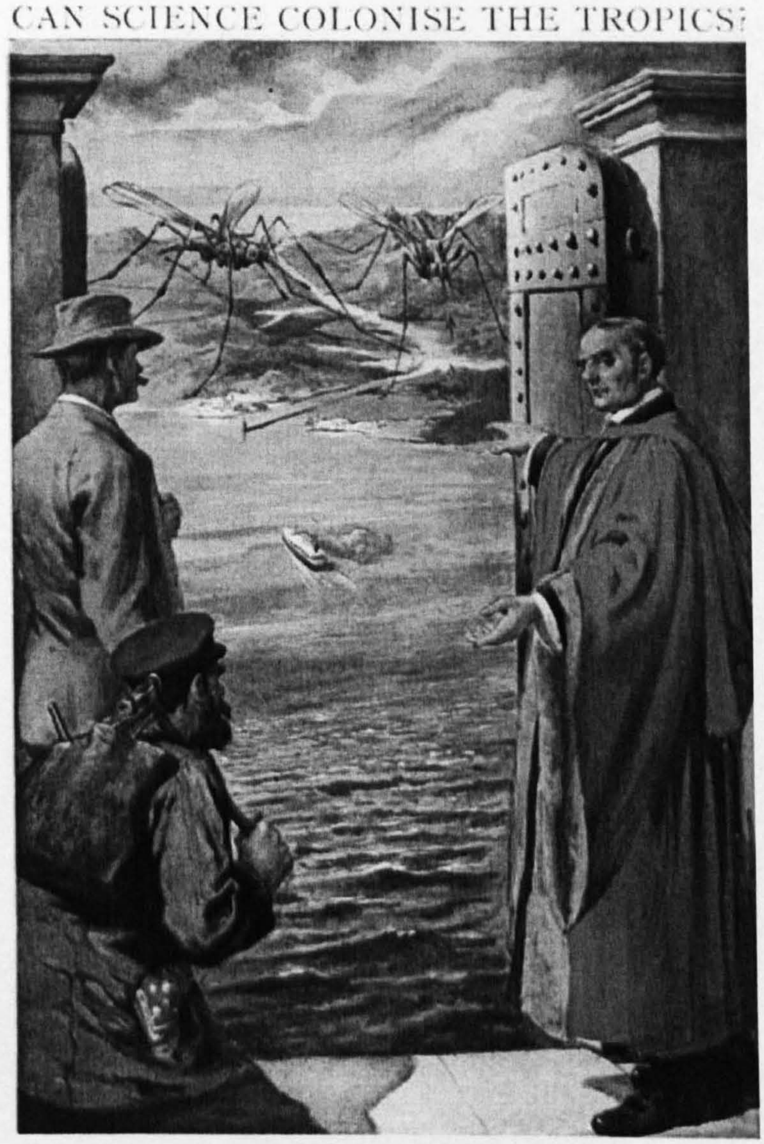
As Naylor explains, "Historical geographers have long been preoccupied with the subject of knowledge", paying attention to the, "close relationships between knowledge, space and place" (2005a:626). Below, four distinct places of the cinchona experiment have been identified, and are dealt with in turn. These are; i) the botanic garden, ii) the plantation, iii) the laboratory and factory (dealt with together to emphasize the role of quinological investigation in the chemical experimentation and manufacture of the drug), and iv) the more abstract print space (where the production, dissemination and exchange of printed material on cinchona and quinine will be considered, and the importance of travel in the formulation of cinchona knowledge explored).

Scientific pursuit became increasingly important to all of the European empires in the nineteenth century, "Indeed, for colonial scientists, science served as metaphor and means of legitimate colonial aspiration..." (Chambers and Gillespie, 2000:226). It was hoped that the tropics could be colonized through the application of science (figure 6.1). Botany, plantation agriculture, acclimatization, and quinology are all here taken to constitute valid branches of scientific investigation, but it should be remembered that in the early decades of the nineteenth century,

> "British botany was largely taxonomic and although the question of precisely which studies qualified as true sciences was still hotly debated, one widespread view was that the true sciences were concerned with mathematics, experimentation, accuracy, precision, and-most of all-with discovering causal laws...botany lacked anything that looked like Newton's laws..." (Endersby, 2001a:346).

Growing cinchona on the Nilgiris was above all, an experimental endeavour, requiring accuracy, precision, and mathematics, and which helped to confirm the value of botanical science to the empire.

Figure 6.1 – 'Can Science Colonise the Tropics?'



Source: Bowler, 2006:176. Full page illustration from *Popular Science*, 1911.[350] A figure in academic robes (probably Sir Ronald Ross who is mentioned in the text) invites white explorers and colonists into the tropics now that the scourge of malaria has been defeated. The Panama Canal is in the background.

[350] *Popular Science* was an American monthly magazine founded in 1872 by Edward L. Youmans, carrying articles for the general reader on science and technology subjects. Early issues contained reprints of English periodicals. The journal became an outlet for the writings of Charles Darwin, Thomas Henry Huxley, Louis Pasteur and Thomas Edison among others. The name of the journal was transferred in 1915 to another publishing group and the academic tradition of *Popular Science* was continued in the new journal *Scientific Monthly* which was absorbed into *Science* in 1958.

In 1975, MacLeod expressed his concern that, "...comparatively little attention has been paid to the development of scientific institutions in the European colonial empires, or to the role of scientific activity in the commercial exploitation, civil government, or political development of individual countries" (1975:343). He presented India in particular as illustrating a "close association between science, technology, imperialism, and emerging nationalism..." (1975:343). Although work on the scientific institutions of the colonies has subsequently grown, there is still a need to disrupt the common view of science as always emanating outwards from Britain (and specifically London) to the colonies, particularly if, as MacLeod declared, Englishmen were apparently more willing to experiment in India than they were at home. The notion of India as a laboratory has been echoed more recently by Prakash who explains, "To the British, India was an ideal locus for science: it provided a rich diversity that could be mined for knowledge and, as a colony, offered the infamous 'elbow room' for an unhindered pursuit of science" (1992:155).

The British population in India found a 'home' at Ootacamund, a place where families could settle, and have no need to fear physical or moral degeneration (chapter 4). Those in the pursuit of science were also more than willing to congregate and settle on the hills, making it an ideal choice for a long-term experiment which would require lengthy periods in the open air. "Scientists gained and maintained authority through their institutions' ability to build lasting connections between colonial society and nature" (Goss, 2004:4), and Ootacamund's position in imperial governance aided the authority of the Nilgiri cinchona team. For anthropologists too, the Nilgiris approximates the "ideal natural laboratory" (Hockings, 1989c:360). Like Shapin in his study of the Royal Society in the mid to late seventeenth century, this chapter focuses on the place of experiment and the exploration of experimental science. "What were the conditions of access to these places, and how were transactions across their thresholds managed?" (1988:373).

Cinchona wasn't the first national experiment in botanical acclimatization to be conducted in the Madras Presidency, the EIC appointing their first professional botanist there in 1786 (Thomas, 2006). The cotton improvement programme of the

1840s was centred on a specially created experimental farm at Coimbatore[351] established by the botanist Robert Wight. This was a place where, certainly to begin with, "...few of the experiments succeeded...but eventually demonstrated that American cotton would grow in that area" (Leacock and Mandelbaum, 1955:337-9),[352] boosting the botanical reputation of the region.

Livingstone and others have cemented the claim that science should be treated like any form of knowledge, "as a cultural formation, embedded in wider networks of social relations and political power, and shaped by the local environments in which its practitioners carry out their tasks" (Livingstone, 2002b:236). Although geography can be viewed as a necessary prerequisite for science as science must of course take place somewhere (Shapin, 2003), the geography of scientific knowledge can be the basis of rich empirical stories (Naylor, 2005b). My aim is to discover where scientific knowledge on the cinchona was discovered, created and negotiated. Which specific locations, institutions and buildings lent themselves to knowledge building? And in turn, how did these places (and the Nilgiris as a local colonial landscape more generally) shape or influence the knowledge that was produced? As Shapin explains, "...science is undeniably made in specific sites, and it discernibly carries the marks of those sites of production..." (1995:306). However, as Lorimer and Spedding make clear, pinning science to the locations in which it is made is no simple matter as, "the precise locations of scientific endeavour are elusive, and require a rethinking of the idea of 'location' that conceives of it as 'distributed and relational', rather than an isolated, at-a-point property" (2005:30).

As Livingstone points out, "the idea that scientific knowledge has a geography goes against the conventional image of science as a transcendental undertaking that remains substantively untouched by the particularities of location" (2000b:285). In a similar vein:

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[351] The lowland district which neighbours the Nilgiris.

[352] In this case though, the experts came from America, some of whom were viewed with strong suspicion. "When the American planter T.J. Finnie began his work in the Tinnevelly district of Madras, he reported that the ryots expressed fears that he was trying to get their lands, also that if the crop was successful the government would raise the taxes on their land" (Leacock and Mandelbaum, 1955:344). On the Madras cotton experiment also see Noltie, 2007, chapter 15.

> How is it, if knowledge is indeed local, that certain forms of it appear global in domain of application? Is the global – or even the widely distributed – character of, for example, much scientific and mathematical knowledge an illusion? If it is the case that some knowledge spreads from one context to many, how is that spread achieved, and what is the cause of its movement? (Ophir and Shapin, 1991:16).

This study considers if, how, and why, observations and data collected on the hills came to be regarded as credible, reliable and authoritative cinchona science, deserving of global attention. Did scientific authority owe something to the location in which the science had been produced, or more to the people who created and disseminated it? As Shapin puts it, "When we point to the setting of knowledge-making activities, we stipulate at the same time those social relations and constellations of value that render the knowledge in question either authentic, safe, and valuable, or fraudulent, dangerous, and worthless" (Shapin, 1991 in Ophir and Shapin, 1991:11).

The study period witnessed a shift from botanical science as an individual amateur pursuit to an increasingly organized, institutionalized and predominantly well documented one under increasing government supervision. Thus the role of institutions like botanical gardens, and the state, both in terms of the creation of spaces of science and their influence on the knowledge produced needs to be acknowledged. In these institutions, "Pleasure, morality and self-improvement were run together with the disciplines of observing, careful and systematic collecting, identification and appropriate display" (Finnegan, 2005:56). The botanic garden is the first space of cinchona science.

6.2 <u>The Botanic Garden</u>

"Between the archive and the field, the world of the museum and the world of nature, stands the garden. Enclosed yet expansive, open yet delimited, the garden is located in a space between the great outdoors and the cloistered cabinet" (Livingstone, 2000b:292). As Livingstone continues, "The early Botanic garden was both a re-creation of paradise *and* a key moment in the genesis of modern science" (2000b:292). In the nineteenth century, the primary aim of botanical gardens in Britain and in the colonies was to acclimatize foreign plants deemed economically or medicinally useful or aesthetically appealing, to British soil. "'Colonisation by gardening' was a ubiquitous, everyday settler activity" (Beinart and Middleton, 2004:14), and the officially designated and government funded botanic garden greatly expanded the possibilities for global plant exchange. Their collective role in the British Empire has now been widely acknowledged (see section 2.1.2 and Brockway, 1979, McCracken, 1997, and Drayton, 2000), colonial gardens forming a complex network over which seeds, living plants, dried specimens, gardeners, botanists and printed material were exchanged.

A number of studies have successfully highlighted the contribution of specific colonial gardens to the advance of acclimatization science.[353] Within India, the Calcutta Botanic Garden is usually singled out as, one of the "earliest institutions in India based on western science", where the Superintendents' salaries reflected their status as scientists (Thomas, 2006:165). Founded primarily to conduct experiments in all things botanical, a large number of food, beverage, trees, spices, textile, and medicinal crops were 'tested' before it was decided which should be the primary focus for the gardens.

In the Government Gardens at Ootacamund, as in the first 'physic' gardens, science and functionality were prioritized over recreation, and medicinal plants were a key component even before the arrival of cinchona (see chapter 4), targeted because, "...the science of medicinal botany conferred on its practitioners power over nature and people alike. And gathering global plant riches into one space – the garden – was the best way of acquiring this power" (Livingstone, 2000b:293). Scant scholarship has been completed on the Ootacamund gardens, despite their active role in the cinchona experiment. The importance attributed to acclimatizing the cinchona to India by those involved in the experiment cannot be underestimated, and the disappointment felt by McIvor and Clements and Minna Markham upon the death of the first batch of plants is obvious (chapter 5).

Failure was an important and inevitable component of acclimatization science, and a frequent occurrence even in the most prestigious of botanical gardens. Numerous experiments were abandoned after only short periods (see Thomas, 2006 and Hastings, 1986). As more cinchonas arrived at Ootacamund, McIvor proposed to

[353] For example see Howard, 1954, 1998 on the St Vincent garden.

safeguard all of the original plant stock at the gardens for propagation, only planting those propagated on site.[354] As Bourguet explains, "...no living plant or seed can be extracted from its native habitat and transferred elsewhere without some elements of its environment (type of soil, degree of heat or moisture) and some precise information (about mode of cultivation, techniques of preparation, or practices of consumption) being imported along with the sample to its new terrain – whether a greenhouse, a garden, or a plantation" (2005:270-271). McIvor knew little of the natural habitat of the cinchonas, so at once put them under the protection of glass, thus placing them in an artificial climate where he could modify moisture and temperature, in whatever way appeared desirable (King, 1876).

As soon as newly arrived cinchonas were considered safe, efforts began to increase their number through a variety of propagation methods; at first by layers (figure 6.2) and afterwards by taking cuttings (figure 6.3). These were well-established horticultural techniques which McIvor had undoubtedly used before, but the cinchona presented a need for innovation.

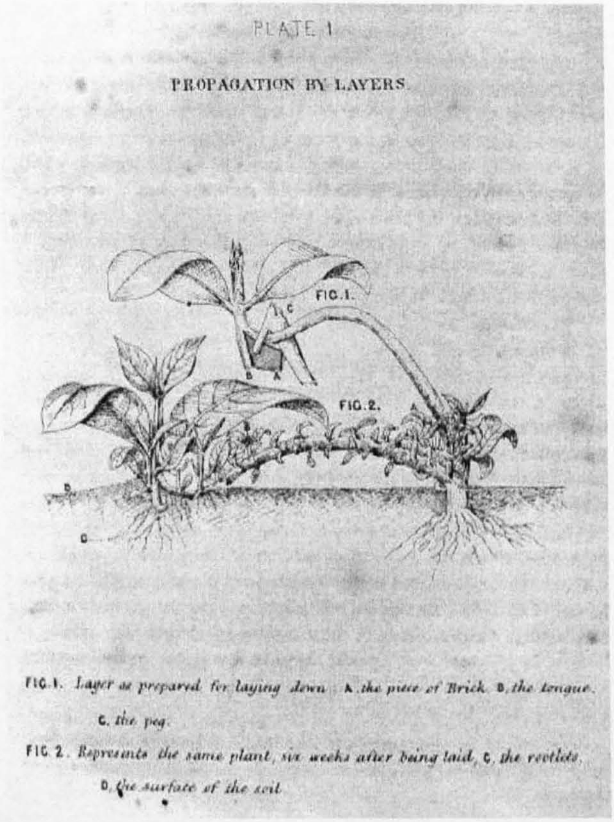
> The principle of layering, being so well known to English gardeners, requires no detail; but in the Chinchona-plants it was found that the layers were very liable to bleed, and this not only weakened the plants but retarded the formation of roots; this we found to be remedied in a great degree by inserting into the cut a triangular piece of perfectly dry broken porous brick (McIvor in Markham, 1862a:567).

All propagation was conducted with the aid of 'bottom heat', or in soil brought to a comparatively high temperature by artificial means (King, 1876). Temperature was a crucial variable:

> In October Mr. McIvor reduced the temperature of one of the propagating houses to 55° at night, and 65° during the day; and, under this treatment, which is also probably advantageous to the bark, the plants appeared to grow faster, and the leaves became a very beautiful bright green (Markham, 1862:487).

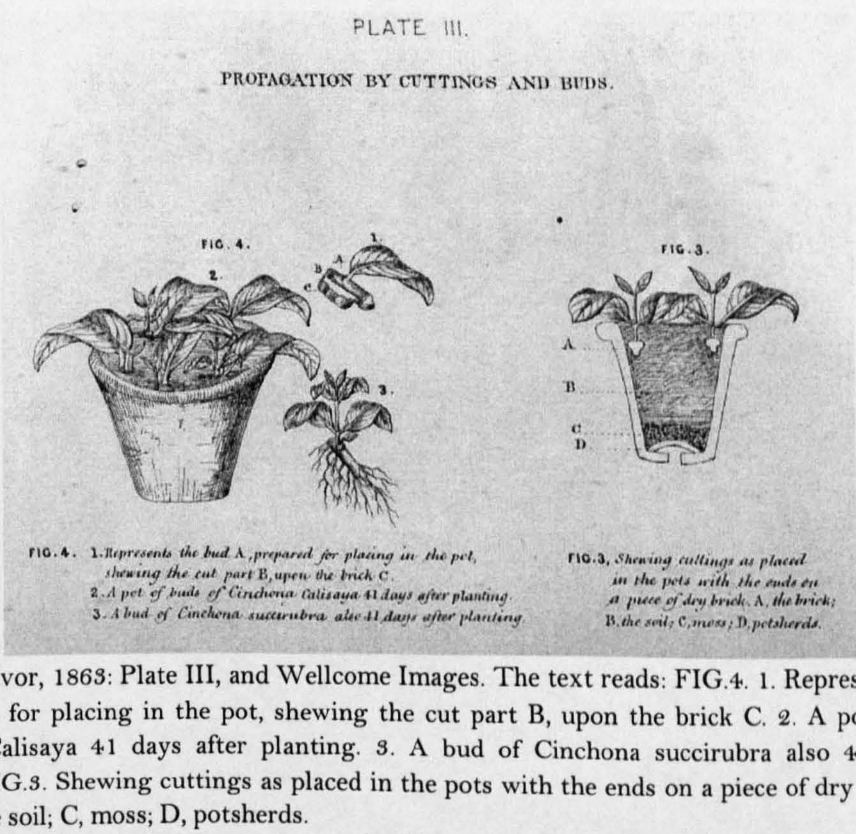
[354] Markham to Under Secretary of State for India, dated Torquay, 30th May 1861. BPP, 1863:167.

Figure 6.2 - Propagation by Layers



Source: McIvor, 1863: Plate I, and Wellcome Images. The text reads: FIG.1. Layer as prepared for laying down. A. the piece of Brick. B. the tongue. C. the peg. FIG.2. Represents the same plant, six weeks after being laid. C.the rootlets. D. the surface of the soil.

Figure 6.3 – Propagation by Cuttings and Buds

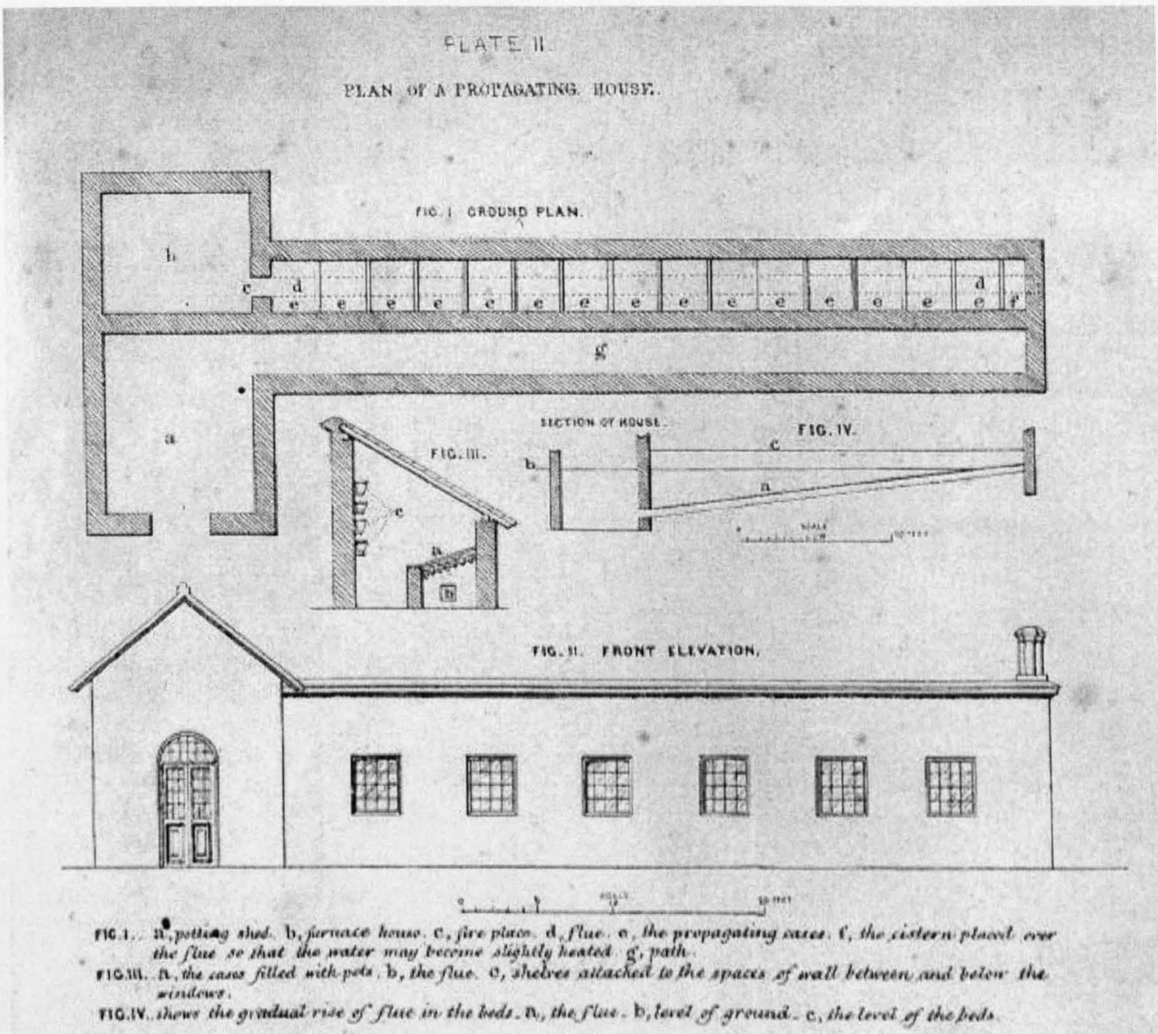


Source: McIvor, 1863: Plate III, and Wellcome Images. The text reads: FIG.4. 1. Represents the bud A, prepared for placing in the pot, shewing the cut part B, upon the brick C. 2. A pot of buds of Cinchona Calisaya 41 days after planting. 3. A bud of Cinchona succirubra also 41 days after planting. FIG.3. Shewing cuttings as placed in the pots with the ends on a piece of dry brick. A, the brick; B, the soil; C, moss; D, potsherds.

Rates of propagation improved once the built-for-purpose propagating house was completed at the end of 1861 (figure 6.4). McIvor proudly announced,

> The house contains fifteen propagating frames, and each of these holds about 1,200 cuttings, or in all sufficient space for about 18,000 cuttings; the house also contains as much space as that occupied by the propagating frames for the growth and propagation of plants by layers and for hardening off such plants as are rooted.[355]

Figure 6.4 - Plan of Propagation House



Source: McIvor, 1863: Plate II. The text reads: FIG.I. a, potting shed. b, furnance house. c, fire place. d, flue. e, the propagating cases. f, the cistern placed over the flue so that the water may become slightly heated. g, path. FIG. III. A, the cases filled with pots. b, the flue. c, shelves attached to the spaces of wall between and below the windows. FIG IV. shows the gradual rise of flue in the beds. a, the flue. b, level of ground. c, the level of the beds.[356]

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[355] AAR, 1861-62. BPP, 1863:240.

[356] Note the similarity of the design to figure 5.6 the cinchona propagating house at Kew.

Located amongst existing propagating houses in the east of the gardens with a nursery for cinchona plants laid out just above, a significant portion of the gardens was now dedicated to the quinine-producing tree (figure 6.5).[357]

The time in which seeds germinated was rapidly reduced from 62 to 16 days, through the use of more open soil and immediate transplanting into fresh earth, and by January 1862 McIvor had around 9,000 plants in the propagating houses, of eight different species, 3,000 of which had themselves attained a size fit for propagation.[358] McIvor had moved away from the Dutch model stating, "It appears to me that much erroneous matter has been published with reference to the cultivation of these plants, and that we have everything to learn."[359] Seeds of *Cinchona condaminea*, received in a letter[360] on the 16th February 1862 were sown immediately:

> The earth was in the first instance exposed to the sun for two or three days and thoroughly dried, it was then heated to about 212° in order to destroy all grubs or larva of insects; after being allowed to cool, it was brought into the potting-shed and watered sufficiently to make it moist...With the soil in this state the pots were filled, the surface lightly pressed down, and the seeds sown thereon, being lightly covered with a sprinkling of sand. The pots were then placed on a slight bottom heat of about 73°. These were never watered in the strict sense of the word; when the surface got dry they were slightly sprinkled with a fine syringe just sufficient to damp the surface, but never to penetrate the soil (McIvor in Markham, 1862a:566).

Seeds were of course more easily distributed than living plants, but it would be several years before they would replace the living plants as the usual method of distribution, not least because Nilgiri-raised cinchonas would take five or six years to flower for the first time.

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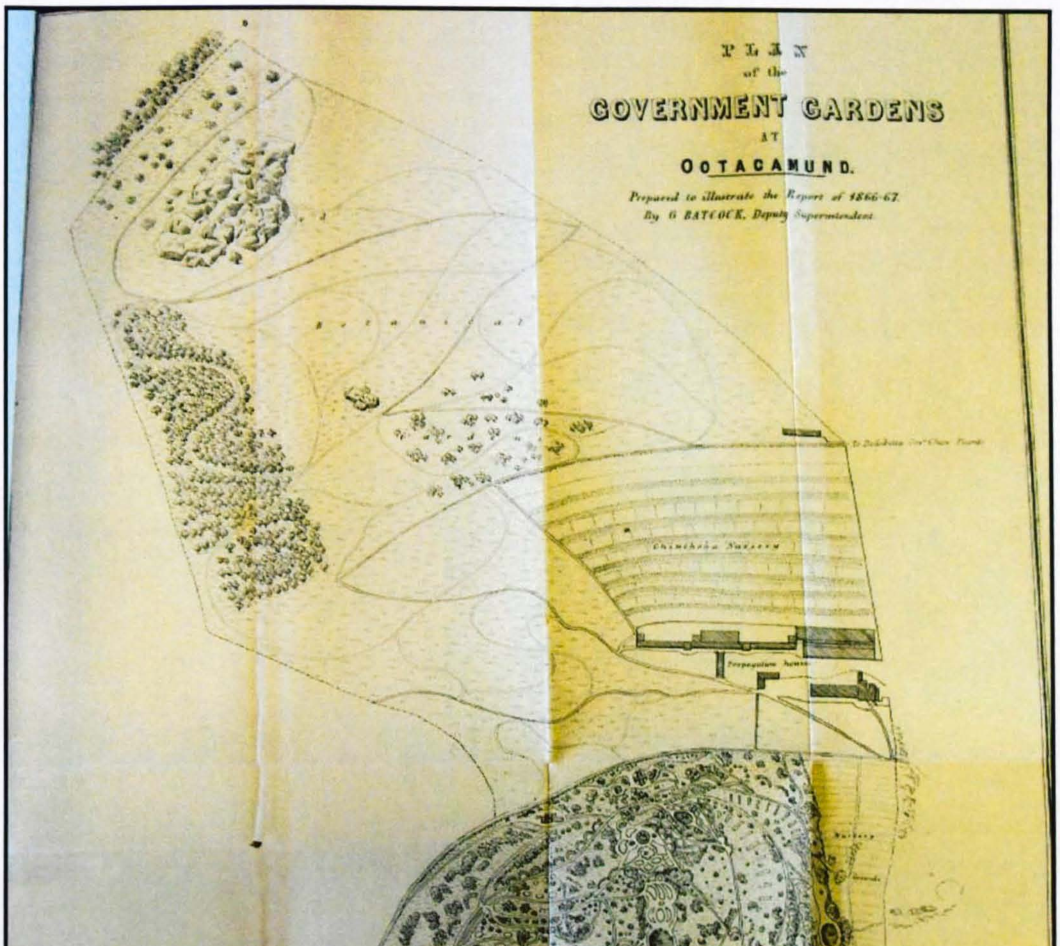
[357] The cinchona experiment did not mean other acclimatization efforts were to be neglected, and in 1865 seven acres at the botanical garden were planted with China and Assam tea, intended for supplying seed to interested planters (Order of the Madras Government, dated 27th September 1865. BPP, 1866:180.

[358] McIvor to Pycroft, Chief Secreatry to Government, Madras, dated Ootacamund 20th January 1862. BPP, 1863:197.

[359] McIvor to Sim, Secretary to Government, Madras, dated Ootacmund 12th March 1862. BPP, 1863:174-175.

[360] A method of transport that McIvor approved of as it allowed the circulation of air that air-tight parcels prevented.

Figure 6.5 - The Government Botanical Gardens at Ootacamund



Source: AAR, 1866-1867. RBGK. MRMC.[361]

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[361] This new plan of the gardens was designed to show the improvements effected since 1857. Notable features are the cinchona nursery and propagating houses and to the north the site for the proposed extension to the botanical gardens. See AAR, 1866-1867. BPP, 1870:132-33 for a fuller description.

No effort appears to have been made in these early stages to prevent cross-pollination of species, a mistake which would later return to haunt the experiment. Heyd's thoughts on botanic gardens sum up the early cinchona activities at the Ootacamund gardens, "Gardens in general are places of trials, of discovery of what works and what does not" (2006:203). In a second sense, Heyd believes the botanic garden to be experimental insofar as its unique assemblages of plants afford new 'experiences', "The experiments in botanic gardens... involve plants and human beings in collaborative living situations: new phyto-adaptations are being tried out, while new experimental spaces for the encounter of human beings with plant life are being set up" (2006:204). The cinchona had never before been positioned so close to the British botanist and seeing it growing at Ootacamund was certainly a new experience for the employees of the gardens and the residents of the Nilgiris.

As an outside and, therefore, largely open space, botanical gardens are one of the more easily accessed spaces of science. Indeed in the majority of cases, visitors are actively encouraged. The role of display was important in boosting morale, illustrating the power of the empire over nature, and in spreading the popularity of the cinchona as a plantation crop. Localized regimes of experimentation assimilated new sites of display (see Lorimer, 2003), visited and admired by local residents and visitors from far and wide (although the notion of cinchona as spectacle or tourist attraction seems to have been capitalized on to a fuller extent in the more visually impressive plantations – see section 6.3).

However, as continues to be the case today, the more 'scientific' work would have taken place behind at least partially closed doors, the propagating house and nursery located in the less public spaces of the Government Garden (figure 6.5). Still, upon request, McIvor was usually only too happy to show visitors the fruits of his labours, and to give advice on method (see below).

As early as January 1862, McIvor reported that plants were beginning to be distributed more widely and in larger numbers, though in most cases movement was to other botanic gardens or members of high society, "Dr Anderson [Superintendent at Darjeeling] was furnished with 204 plants of our most valuable species for introduction in Bengal, and 16 have been forwarded to Mr. Maltby for the Rajah of Travancore."[362] After the termination of the official arrangement between the RBGK and the India Office on 29th March 1862,[363] the Government Gardens at Ootacamund became *the* dissemination point for cinchonas around the world and, by May 1866, McIvor and his team had sent Nilgiri cinchonas to Java, Jamaica, Algeria, New Zealand, Australia, Mauritius and Réunion as well as fulfilling numerous orders throughout India (figure 6.7).[364] McIvor justified charging for the young cinchonas in the following terms, apparently not particularly interested in the revenue that could be obtained from them.

> Persons do not generally value that which they receive for nothing, whereas those who purchase plants at a fair price establish by this act that they value and consequently will take care of them; moreover, it will induce purchasers to propagate and increase the plants themselves, and thus greatly facilitate the extension of their cultivation.[365]

Recent experiments on the Nilgiris had concentrated on determining the safest and cheapest method of transporting plants, and McIvor and Cross had both issued their own *Hints on packing and conveying plants in Wardian cases* to Kew in 1861,[366] illustrative of their developing expert status in the rapidly expanding field, and the need for guidelines on transport. Wardian cases could now be supplied at the gardens at a low cost (Rs 15), and would be packed with between 170 and 220 plants depending on the species (previous guidelines had suggested only 28 to 30 plants should be placed in each case). Moss (a material McIvor would become somewhat obsessed with) replaced earth as the preferred packing material, and it was advised that for journeys of less than one month (to destinations like Calcutta and Ceylon) the cases could remain shut for the duration of the voyage. For journeys of less than 80 miles, McIvor deemed transportation in open baskets as perfectly safe, with around 50 plants forming a *cooly* load (figure 6.6).

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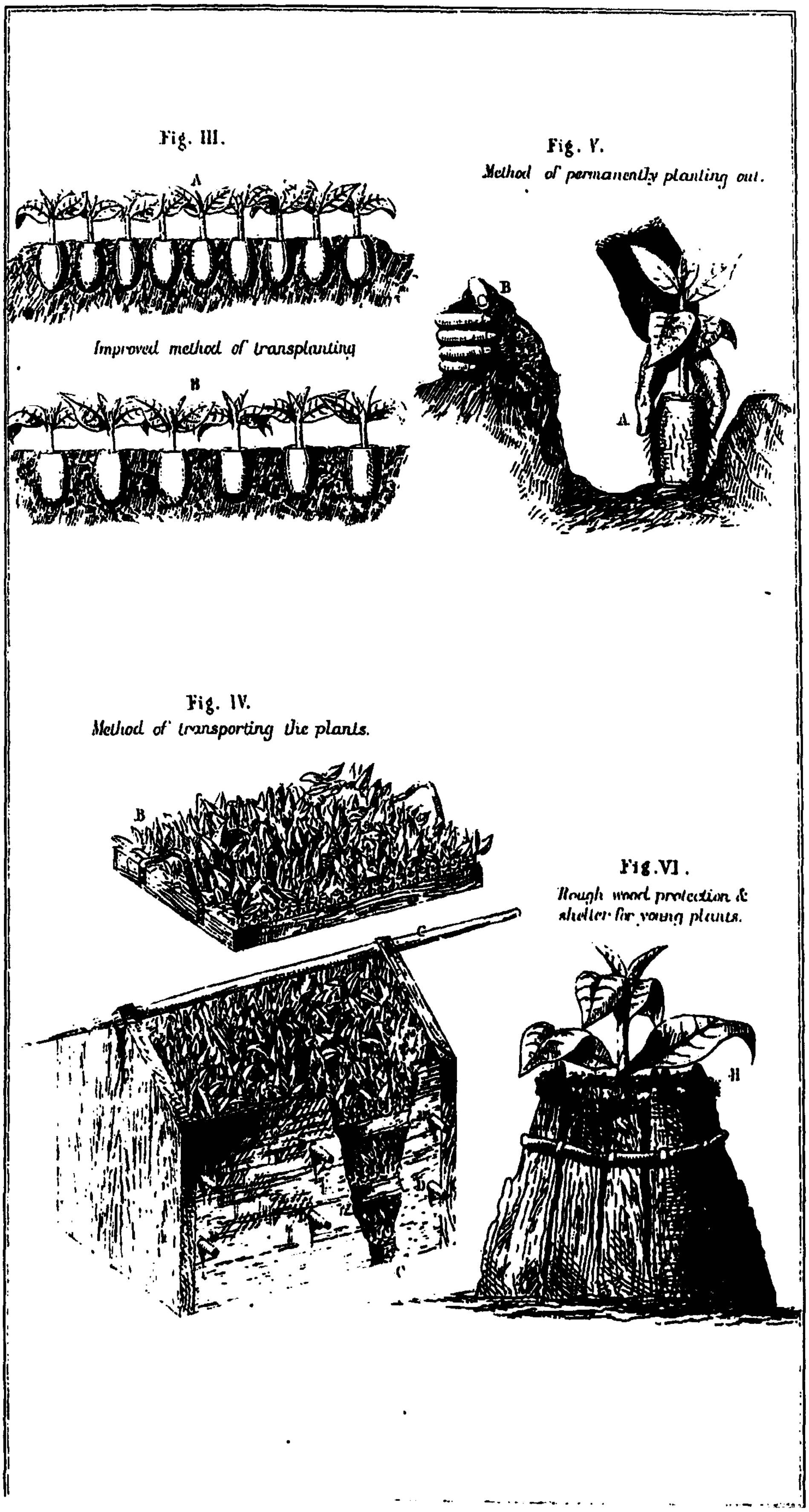
[362] McIvor to Pycroft, Chief Secreatry to Government, Madras, dated Ootacamund, 20th January 1862. BPP, 1863: 197.
[363] Herman Merrivale to the Under Secretary of State for Foreign Affairs, dated India Office, 29th March 1862. BPP, 1863:272.
[364] Register of cinchona plants distributed to 30th June 1866. BPP, 1870:18-19.
[365] AAR, 1861-62. BPP, 1863:243.
[366] (I) Hints on packing and conveying plants in Wardian cases by W. McIvor and (II) Hints on packing and conveying plants in Wardian cases by R. Cross. RBGK. IEPC.

Figure 6.6 - Methods of Planting and Transporting Cinchonas



Source: AAR, 1864–1865. BPP, 1866: facing p.163.

Figure 6.7 - Orders and despatches of cinchona plants up to the end of May 1866

TABLE IV.—Register Chinchona Plants Distributed.

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Mr. F. N. Maltby	Trevandrum	16	The number of plants issued to the public during the month is 1,952, making the total distributed 1,02,709.
Dr. Junghun	Java	56	
Mr. A. R. Lascelles	Ootacamund	12	
Mr. M. Anderson	Jamaica	2	
Dr. Wiche	Bombay	10	
Dr. T. Anderson	Calcutta	564	
Dr. Jamieson	Saharanpore	107	
Professor Lees	Calcutta	547	
Rajah of Travancore	Travancore	521	
Major Morgan	Ootacamund	1,534	
Mr. E. T. Fitzgerald	Calcutta	558	
Mr. J. W. B. Money	ditto	1,369	
Mr. W. Bourne	ditto	532	
Captain Cox	Wynaad	6	
Mr. Hollock	ditto	2	
Mr. T. Sheffield	Ootacamund	12	
Dr. F. Day	Cochin	100	
Mr. Brown	Tellicherry	12	
Mr. J. Hall	Ootacamund	[illegible]	
Mr. T. Knop	ditto	18	
Captain Lees	Bengal	386	
Mr. W. H. Rayne	Manantoddy	424	
Reverend Sawyers	Ootacamund	1,018	
Mr. Frend	ditto	512	
Mr. Hollock	ditto	1	
Mr. J. Pierie	Seegoor	12	
Colonel Scott	Ootacamund	1,236	
Mr. Berend	Cachar	275	
Reverend J. Hunter	Coonoor	12	
Mr. T. Mullaly	ditto	100	
Mr W. H. Stanes	ditto	1,262	
Colonel R. Cooper	Kotagherry	12	
Mr. F. Cockburn	ditto	12	
Colonel Woodfall	Coonoor	12	
Mr. C. Anderson	ditto	24	
Colonel Angelo	Ootacamund	12	
Reverend E. Laseron	ditto	12	
Captain R. N. Taylor	Coorg	96	
Major W. Agnew	Assam	139	
Mr. V. H. Levinge	Madura	12	
Chief Commissioner of	Nagpore	26	
Mr. Fletcher	Ootacamund	24	
Gool Mahomed	ditto	20	
General McCleverty	New Zealand	23	
Mr. W. Robinson	Kotagherry	330	
Mr. Clarke	Wynaad	12	
Mr. H. R. Dawson	Seegoor	12	
Captain Mann	Coorg	48	
Mr. E. Roberts	ditto	580	
Mr. H. Russell	Wynaad	52	
Reverend Wait	Coonoor	2	
Collector of Belgaum	Belgaum	28	
Collector of Honore	Honore	28	
Dr. Ross	ditto	15	
His Excellency the Governor	Bombay	158	
Mr. H. Hindo	Wynaad	12	
Mr. E. B. Thomas	Coonoor	274	
Rajah of Poongunoor	Poongunoor	12	
Major Grant	Wellington	226	
Messrs. Thomas, Shaw & Co.	Poonganoor	28	
Mr. J. H. Trinson	ditto	31	
Dr. Muller	Melbourne	28	
Mr. Tyrrell	Mysore	12	
Dr. Sayers	Vellore	12	
Major C. P. Taylor	Ootacamund	5,250	
Dr. Wilson	ditto	6	
Mr. Schannarrie	ditto	15,000	
Captain Fuller	Coonoor	417	
Dr. Drummond	Ootacamund	224	
Captain Jennings	ditto	1,756	
Lieutenant H. B. Montmorency	Bangalore	6	
Mr. McHutchin	Ootacamund	3	

TABLE IV.—Register of Chinchona Plants Distributed—*continued.*

NAMES.	STATIONS.	Number of Plants.	REMARKS.
Colonel Molesworth	Ootacamund	6	
Mr. C. Gray	Coonoor	12	
Mr. H. B. Liddell	Ootacamund	12	
Mr. Minchin	Wynaad	1,600	
His Excellency the Governor	Vizagapatam	35	
Mr. R. F. Phillips	Kotagherry	1,117	
Colonel Cooke	ditto	24	
Mr. G. J. Glasson	Wynaad	1,000	
Dr. Macpherson	Mercara	400	
Mr. W. H. Kerr	Coorg	3,100	
Mr. James	Ootacamund	1,000	
Colonel Whish	Bengal	82	
Mr. K. Mair	Calcutta	1,180	
Mr. W. Shakespear	ditto	61	
Mr. E. E. Meakin	ditto	108	
Mr. C. Ackland	ditto	150	
Mr. K. McIver	ditto	124	
Mr. Havelock	Ootacamund	12	
Mr. H. de Facien	Kurtairy	6,821	
Major Sweet	ditto	910	
Captain Campbell	Bangalore	6	
Royal Gardens	Mauritius	36	
Honourable W. R. Arbuthnot	Wynaad	93	
Mr. H. Maxwell	Bombay	50	
Mrs. C. Smith	Wynaad	316	
Captain Meekley	Wellington	200	
Mr. Walsh	Salem	150	
His Excellency the Governor General	Java	175	
Captain Richardson	Kulbutty	509	
Rajah of Poonganoor	Poonganoor	24	
His Excellency the Governor	Madras	24	
Mr. J. W. B. Money	Ootacamund	25,000	
Captain Mitcheson	ditto	50	
Mr. R. H. Elliot	Munjerabad	157	
His Excellency the Governor General	Goa	252	
Colonel Phayre	Rangoon	152	
Mr. Ryall	Kotagherry	24	
Mr. J. Gordon	Coonoor	3,401	
Mr. J. Rohde	Neddivuttum	11,680	
Mr. J. Higginbotham	Goordaloor	12	
Mr. S. Pital	Mauritius	36	
Mr. J. Horne	ditto	36	
Mr. Edouard Cremary	Reunion	51	
For the French Government	Algiers	46	
Mr. J. B. Norton	Shevaroys	50	
Mr. Mackay	Punjab	50	
Mr. W. Forsyth	Central Provinces	100	
Colonel Cadell	Coorg	62	
Mr. J. L. Browning	Wynaad	4	
Mr. H. Leeds	Burmah	112	
Maloo Sait	ditto	6	
Mr. A. D. Brown	Dimhutty	53	
Mr. J. C. Misquith	Ootacamund	300	
Mr. J. L. Pransen	Coonoor	8	
Captain Fitzgerald	Calcutta	150	
Mr. J. Macpherson	Ootacamund	12	
Major Travers	ditto	5,000	
Mr. S. Preger	Vithry, Wynaad	60	
Reverend Wenger	Kuity	2	
	TOTAL Number of Plants	102,700	

Ootacamund,
21 July 1866.

(signed) *W. G. McIvor,*
Superintendent Government Chinchona Plantations.

Source: BPP, 1870:18-19.

Wherever possible, McIvor kept tabs on his plants even after they had left the gardens. Predictably, not all faired well. With the submission of his annual report for 1863-4, McIvor reported that;

> Upwards of 60 persons have, in a greater or less degree, undertaken the cultivation of chinchona, but, as was to be expected, with varied results; the efforts of some being highly successful, while others met with comparative failures; among the most unsuccessful attempts may be mentioned those of Professor Lees and M. de Facien, both of these gentlemen, in the first instance, lost nearly four-fifths of their plants either in transit or in the nurseries. Experience, however, has pointed out a remedy; and I learn from Mr. Lee's superintendent that his plants are now doing well, and that he is propagating them at the rate of 200 per memsem. M. de Facien also writes, that his plants 'are, since the shade has been removed, growing as they never did before.'[367]

On procuring a supply of young plants, planters often met with McIvor in person. Robert Henry Elliot, a planter resident in neighbouring Mysore who experimented with a number of different crops, visited the Nilgiris and McIvor in 1865, taking the opportunity to observe the system of cultivation and to obtain some cinchonas for himself, "When I visited the hills in 1865, I made the acquaintance of Mr. McIvor, and had every opportunity of observing this system of propagation...The buds were, first of all, rooted in brickdust, with the smallest proportion of vegetable mould, and, after they had rooted, were transplanted into stronger soil" (Elliot, 1871:161-162).

The price of a single cinchona was eventually reduced to one anna, and sometime before 1876 to just two pies or in some cases distributed without cost (King, 1876). In time private nurseries opened up, many staffed by those who had learnt their trade under McIvor, and the demand on the Government Gardens fell. But this did not mark the end of the Government Garden's role, as it remained, in Heyd's (2006) words a sort of 'living warehouse', a reliable source of new stock for the planter. "The Red bark trees began to yield seed in 1866, and the other species followed soon after" (King, 1876:22). In 1867, McIvor reported of the seeds distributed, "Reports daily reach us of their excellence, and the great number of young seedlings raised from them."[368] The crop of seeds for the following season was predicted to be

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[367] AAR, 1863-1864. BPP, 1866:102.
[368] AAR, 1866-1867. BPP, 1870:122.

large, and McIvor suggested that a portion be distributed gratuitously to planters likely to take care of them. The uptake was eager. "Upwards of 100 ounces of Chinchona seeds have already been distributed to the public from this establishment, and as each ounce of seeds should produce 20,000 young plants, these seeds would furnish the enormous number of 2,000,000, a number more than sufficient to meet the requirements of all private planters."[369] Accordingly, the demand for plants soon fell, and propagating operations were limited.[370]

From the end of March 1878, private advertisements appeared with greater frequency in the *SIO* for cinchona seed, seedlings or plants from private sources, "For sale Tea and Cinchona seedlings, ready for immediate delivery. Apply to W. Teare, The Nilgiri Tea and Cinchona Company, Ootacamund."[371]

A crucial connection always exists between geographical location and sound reputation (Livingstone, 2005), but the association between the Government Garden and quality cinchonas was not immune from attack. On a number of occasions the Darjeeling cinchona team was only too happy to name Nilgiri plants as the source of disease in their plantations, and private planters were not afraid to complain about the poor quality of the seed they had obtained from the Government Gardens, particularly after McIvor's death. On the 19th January 1881, Cross undermined the scientific nature of the Nilgiri operation when he wrote from the Government Gardens at Ootacamund to the Under Secretary of State for India, "All are now going on well and 4 cutting plants obtained from the Santa Fe are now rooting – I had to keep the plants for some time in the open air the propagating houses were in such bad condition in fact they had never been in a good state."[372] Although it should be noted that it seems to have been in Cross' character to complain and make accusations!

Within the Government Gardens certain sites became more important for science than others. McIvor converted one of the garden buildings into a herbarium and library, aware of the need for places where printed and dried material on the

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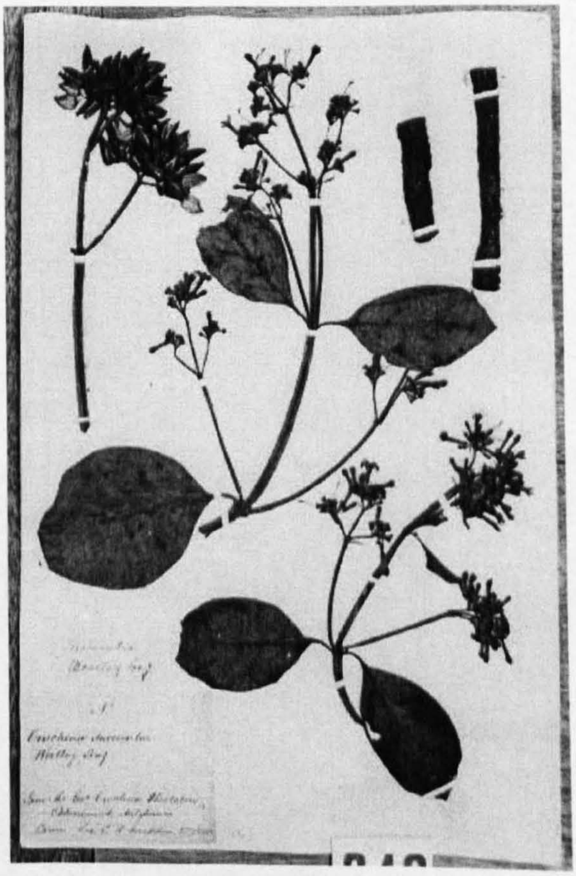
[369] McIvor to Acting Under Secretary to Government, dated 1st June 1868. BPP, 1870:185.
[370] AAR, 1867-1868. BPP, 1870:175.
[371] BL. *SIO*. 27th March 1878. p.1, col. C.
[372] Cross to Under Secretary of State for India, dated 19th January 1881. Underline probably added at Kew. RBGK IEPC.

cinchona could be perused. As Endersby explains "Colonial herbaria were tools with which Hooker persuaded colonial collectors to adopt his collecting and classifying practices. They also served as local centres of calculation: as Kew's herbarium attracted a network of collectors, so colonial herbaria helped Hooker's correspondents build their own networks" (Endersby, 2001a:354). If a botanist did not have access to a herbarium, he was often seen, by association, to lack the abilities and authority needed to actively forward science through for example, the naming of species, although collectors in the field often felt their direct presence in the field gave them unique insights which could not be found in the dried specimens of the herbarium (see Endersby, 2001a). McIvor now had both of these advantages, being in the field with living cinchonas, and also slowly creating his own cinchona library of books and dried specimens. Specimen sheets were frequently requested by Kew and the India Office (figure 6.8).

Figure 6.8 – Herbarium Specimen (RBGK), *Cinchona succirubra*, Ootacamund



Source: Wellcome Images

Certainly a centre of dissemination of advice and plants, as well as a collection point for printed material (see below) and young plants and seeds, and a prominent node in the cinchona network, the Government Gardens at Ooty could also be considered as a Latourian 'centre of calculation' in the context of the cinchona experiment, a label often deemed to sum up Kew Gardens role in the British Empire. For Dritsas, "the centre of calculation proves to be a fictitious place if it is assumed to be the end of the line where all the further analytical work was performed" (Dritsas, 2005:50), and this picture is mirrored by the fractured histories of the bark samples now housed at Kew.[373]

The place in which science is pursued is always central to the veracity of the knowledge produced. As Naylor (2005b:6) writes, "such sites act as 'truth spots' bringing certain actors together, keeping others out, facilitating particular practices and constraining others". Out in India, McIvor could never achieve ultimate authority over the course of the cinchona experiment, but he did establish the reputation of the Government Gardens, and made a name for the quality of the garden's productions, as well as for himself, doing much to advance cinchona science.

Heyd sees a second role of botanic gardens as 'models' for extended experiments outside of the botanic garden, "…in the gardens adjoining people's homes, in city parks, and perhaps, up to a point, in the agricultural lands outside our cities" (2006:205). The Government Garden at Ootacamund definitely met these criteria, in conducting experiments in cultivating cinchona that were promoted amongst the planting population, who were actively encouraged to follow suit. Leaving the confines of the garden for the plantation marked the next stage of the experiment, a stage many other acclimatization projects would not reach (Hastings, 1986).

6.3 The Plantation

MacLeod has explained how, "in her cultivated plantations and her critical natural resources, India's wealth was repeatedly tapped through the use of scientific knowledge and techniques" (1975:344). Scientific knowledge advanced plantation agriculture and aided good governance. "The application of science could even help

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[373] See Dr. Mark Nesbitt's recent project which attempted to cross reference specimens and written materials relating to cinchona at the RBGK. http://www.kew.org/collections/ecbot/collections/topic/cinchona/index.html [accessed 16/01/2010].

the colonies, and India, to become self-sufficient – a goal of successive British administrators for nearly a century" (MacLeod, 1975:350). Indian self-sufficiency in quinine products was certainly a priority, and it was only in the commercial plantation that this could be achieved.

In earlier experiments (most notably tea), government owned and run plantations (as opposed to just small numbers of specimens within botanic gardens), had been insisted upon because of the unwillingness of the residents of the region to adopt the cultivation of unfamiliar plants (see Thomas, 2006). Government plantations (table 6.1) were to be the strategy for cinchona too (certainly while a private industry in the bark established itself), to act as both as models and as business ventures in their own right.

6.3.1 Geography and Selection

From May 1861, planting trials were underway under a variety of environmental conditions. A plot of land (approximately 50 acres in extent) above the Government Gardens, named the Dodabetta[374] plantation had been dedicated an experimental or "pioneer" (Folke, 1966:205) cinchona plantation, "...i.e., a plantation in which to test what amount of exposure or shade, and description of shade, or soils and subsoils, are best suited to the growth of cinchonas, and the development of their alkaloids."[375] The site, together with a second at Naduvattam, had been selected by McIvor and Markham late in 1860, because of their apparent similarity to the natural home of the cinchona which Markham had recently observed. "Like the thickets where the Cinchonae abound on the Pajonales of Caravaya, in Peru, it [Dodabetta] is surrounded by steep grassy slopes, with analogous vegetation...The temperature appears to be almost identical with that of the Peruvian pajonales..." (Markham, 1862b:29).[376]

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[374] After the highest peak on the Nilgiris, Dodabetta.
[375] McIvor to J.W. Breeks,Private Secretary to His Excellency the Governor, dated Ootacamund, 4th June 1861. BPP, 1863:176.
[376] Markham relied upon General Ouchterlony's account for a record of Dodabetta temperature (see Markham, 1862a:382).

Table 6.1 - Government Cinchona Plantations on the Nilgiris, 1860-1900

Plantation	Sub-plots/ Estates	Elevation (ft above sea level)	Acreage (maximum extent)	Dates of Existence
Dodabetta	First Dodabetta	7,830-8,350 ft	413	Established 1861. Still in existence 1900.
Naduvattam	First Denison Second Denison Markham Kilgraston Napier	5-6,000 ft	601	Established 1861. Still in existence 1900.
Pykara	Wood	3,400-6,500 ft	128	Established 1862. Greater part of Wood Estate abandoned 1887, remaining trees uprooted 1895.
	Hooker		172 Extension of 80 acres made in 1898 and another 80 acres in 1899, proposals for another in 1900.	Established 1862. Still in existence 1900.
Mailkoondah	Stanley Upper Estate Stanley Lower Estate		75	Established 1865. Abandoned 1871. Uprooted 1879.

Source: Data collated from the AARs.

In the early months at Dodabetta, particular attention was paid to investigating the effects of shade, and as George King recollected in his *Manual of Cinchona Cultivation in India*, "It was found at the end of six months that plants which had been put out in the open without any shade, either artificial or natural, much surpassed in size and health others which has been planted out at the same time under the shade of forest trees" (1880:19). McIvor thus adopted a plan of planting in open cleared ground with the density of planting varying between seven and ten feet depending on the size of the species. This workmanlike approach was in stark contrast to that being practiced by the Dutch, where small numbers of cinchonas were scattered over virgin forest. McIvor did, however, plant 40 acres in accordance with Dutch intelligence, but 30 of these were soon cleared of their shade trees and converted to open plantations, leaving ten acres as a reminder of what not to do (King, 1880), the Dutch later also switching to the English mode.

Elevation was crucial, as it was already known that different varieties of cinchona succeeded at different altitudes in their original habitat. Dodabetta plantation occupied the highest elevation that could be found south of the Himalayas and also offered the advantage of being relatively close to the Government Gardens and the town of Ootacamund where provisions could be obtained. It was supposed by Markham and McIvor that Dodabetta would suit cinchona species which grew at the highest elevations (*Cinchona calisaya, nitida, condaminea, crispa,* and *lancifolia,* Markham 1862a:380-381). The presence of "chinchonaceous" plants further suggested its suitability (Markham, 1862a:383).

The land selected for the Dodabetta plantation (and the vast majority of all government and private cinchona ventures opened subsequently), was *shola* (a significant marker of the picturesque landscape, alongside streams, waterfalls and *ghats* (Sutton, 2009)), needing to be cleared of trees before a plantation could be laid out. McIvor it seems saw an opportunity to make some money and attempted to sell the felled wood from the Dodabetta site privately. "He was finally reprimanded when in 1863 he advertised a contract in the Neilgherry Excelsior newspaper for the wood to be felled on Dodabetta hillside" (Sutton, 2009:120).[377] These forested sites were also not entirely empty of human occupation, as Markham himself recounts in his published account of his time in Peru and India,

> On the edge of the forest there was a little hut… It was the habitation of a family of Moloo Kurumbers, a wild race who live in the forests, and run away in great terror when anyone approaches them. The establishment of the plantation will soon make them alter their haunts from the neighbourhood of Neddiwuttum (Markham, 1862a:387-388).

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[377] See Sutton, 2009, chapter 5 for a more detailed account of the conflicting priorities of forest preservation and plantations.

It was customary for government to reserve large areas of forest land for the extension of cinchona cultivation, fell portions of the land for plantations, and then to sell off the remainder of the unwanted land to private buyers.[378]

As overall focus was to be placed on the cultivation of the *Cinchona succirubra* (the species currently thought to possess the highest levels of alkaloid in its bark), which grew at lower elevations; the most extensive planting operations were to be concentrated at Naduvattam.

> The land available for immediate occupation comprises about 400 acres of uncleared forest on the mountain slopes, at an elevation from a little over 6000 to a little under 5000 feet above the level of the sea, and with a mean temperature about 8° warmer than that of Ootacamund… a temperature exactly similar to that of the forests where the above species [*Cinchona succirubra, calisaya, micrantha,* and *peruviana*] of cinchonae flourish (Markham, 1862a:385-386).

In the selection of plantation sites, authority was always awarded to those who had seen cinchona growing firsthand, either in South America or in Java (where the Dutch experiment was a couple of years ahead of the British), often in disregard to the observer's lack of botanical knowledge. As Markham noted of the Naduvattam site,

> The only person who has visited this site since its selection, who is capable, through personal knowledge of the South American chinchona forests, of forming an opinion, is Mr. Cross… he not only approves of it for the cultivation of plants of the 'red-bark' species, but that, from the superior depth and richness of the soil, he considers that they are likely to thrive even better than in their native forests… (Markham, 1862a:387).

As seen in chapter 5, not everyone agreed.

The geography of these sites was an enduring challenge. The remoteness of the Naduvattam site (around seventeen miles from Ootacamund)[379] led to some difficulty in getting artisans to proceed there, meaning delays in construction

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[378] For example, 2,500 acres of shola were originally reserved by government at Mailkoondah, but the plantation never exceeded 75 acres. See Minute by Sir William Denison, dated 30th October 1865. BPP, 1866:185.

[379] This distance is taken from a letter from D. Macpherson, Inspector General of Hospitals to J.D. Boudillon, Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 5th February 1861. BPP, 1863:149.

work.[380] As "as an open space it [the plantation] was less easily defined, bounded and policed than its intramural counterparts like the laboratory or the museum whose confines are more clearly circumscribed" (Livingstone, 2000a:290). The government plantations were enclosed to keep out trespassers (including wandering cattle), but boundaries were often ill-defined and took time to erect. Robert Cross offered the following advice, "In making plantations of cinchonas… A fence should then be made along the summits of the banks, to prevent the burghers and todahs from feeding their cattle among the cinchona trees."[381] Nevertheless, the plantations openness allowed for the engagement of the whole Nilgiri community in knowledge making about the cinchona tree. The first cinchona plants were permanently planted out by the Governor of Madras Sir William Denison, on the 30th August 1862 (figure 6.9).[382]

On the 6th September 1862 McIvor recommended that a third plantation of at least 100 acres be opened to the east of the Pykara Waterfalls,[383] a popular beauty spot. Denison recommended to government that McIvor should be allowed to begin to prepare the site.[384] McIvor pushed on with clearing the site, but apparently ignored instructions to leave a sufficient fringe of wood along the banks of the river, in the opinion of some residents, spoiling the commonly visited and much photographed tourist attraction[385] an act for which he would later be reprimanded, and threaten his resignation for.[386] However, as Sutton explains, "These reprimands constituted little more than temporary diversions in the evolution of a forestry which increasingly relied on the destruction and re-invention of the Nilgiri forests. After local officers salved government's concern, felling continued" (2009:147). The Pykara site was divided into two plantations, named Wood and Hooker, after Sir Charles Wood and Sir William Hooker. A fourth government plot was also added at Mailkoondah in the Koondah range, described by Markham as the finest hills he'd visited in India and the best site yet selected for cinchona (King, 1876). In 1865, 75 acres were planted with 65,254 trees, principally *Cinchona succirubra.* However geography once again came into play, the physical distance from

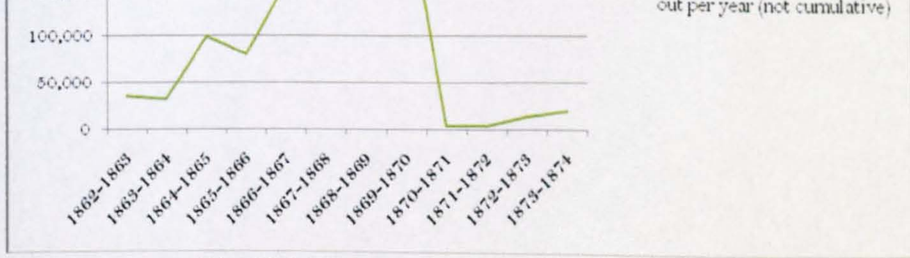
[380] AAR, 1861-1862. BPP, 1863:242.
[381] Report from Cross to the Under Secretary of State for India, dated 9th November 1861. BPP, 1863:172. Cattle would, at a later stage, be an essential component of the cinchona plantations.
[382] AAR, 1864–65. BPP, 1866:162.
[383] Memorandum from McIvor, dated 6th September 1862. BPP, 1863:243–44.
[384] Minute by Sir William Denison, dated September 1862. BPP, 1863:245.
[385] Collection of correspondence relating to the matter. No. 33. in BPP, 1866:69-82.
[386] McIvor to Sim, dated Ootacamund 11th October 1864. BPP, 1866:74.

Ootacamund eventually outweighing Mailkoondah's natural advantages, as finding and keeping labour proved extremely difficult (see chapter 7 and King, 1880:19).

Figure 6.9 - 'Peruvian Bark Tree Plantation in the Neilgherry Hills, India: Sir William Denison, Governor of Madras, Planting the First Tree in a New Plantation'[387]

Source: Anon. (1862b). The cultivation of quinine-yielding cinchona trees in Southern India. *The Illustrated London News*. December 6th 1862: 592, and Wellcome Images.

Figure 6.10 - Cinchona Planting by Year, 1862-1874



Source: AAR, 1874-1875:4. RBGK. MRMC.

387 Denison is the seated figure and McIvor is the man holding the spade.

Private planters moved relatively quickly in devoting portions of their existing land to cinchona, or purchasing new sites for the tree's cultivation. Although relatively small in number, these were experienced and prominent society men. Many had military backgrounds, some had connections to government, and most had some prior knowledge of planting – usually coffee. As MacLeod explains, "The active spirit of capitalist enterprise among Englishmen in India as in her other colonies, had, from the early eighteenth century, directed itself to the development of the plantation industries" (1975:346).[388] Kumar, in his study of indigo planters, acknowledges that these planters belonged to an affluent class, even if they were not empowered directly, "They willingly came to this distant land with dreams of striking it rich" (2007:2). Even though European planters often led somewhat isolated lives in a strange land, Kumar found that, "The planters living in the indigo districts had also assiduously re-created an English lifestyle for themselves marked, for instance, by English dining, the consumption of favourite liquors imported from home and the organization of dances, and by New Year, Christmas and many other parties" (2007:3). The Nilgiri cinchona planters followed largely similar habits (see chapter 4).

In terms of distribution, private plantations were, in the main, clustered around the Dodabetta and Naduvattam sites, selection influenced no doubt by the presence of the government estates (alongside coffee estates at Naduvattam), as well as basic geography (including water supply) and infrastructure (namely the presence of passable roads to transport essential supplies, harvested bark, and labour). Remember that the selection of new plantations was also restricted by the Wasteland Rules (see chapter 4).

When Markham returned to Ootacamund in January 1866, he was impressed with the progress that had been achieved.

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388 MacLeod uses the introduction of cinchona as an illustrative example.

> When I selected the sites for plantations in 1860–61, they were covered with dense jungle. Now the scene is so altered as to be beyond recognition: acres of ground are covered with rows of Chinchona trees, with their lustrous crimson-veined leaves and fragrant flowers; and in one place they have grown to such a size that the foliage of their branches mingles and entirely conceals the ground. They have become so important and distinctive a feature of the fine range which overhangs the Moyaar Valley, that it should be known henceforth as the Chinchona mountains.[389]

Markham wrote to the Under Secretary of State with more details regarding private planters,

> Mr. Morgan has an establishment for propagating and distributing Chinchona plants. Mr. Money is opening a fine estate of 500 acres in the Deva Shola, the largest forest on the Neilgherries. Colonel Fyers has an estate on the Koondahs; Colonel Denison and Captain Jennings have commenced planting near Ootacamund; the Carnatic Company above Neddiwuttum; Colonel Scott at Mailoor; Mr. Grove and Mr. Morgan near the Pycarrah Falls; Dr Colvin Smith and others at Kotergherry; and of the 85 persons who have purchased land on the Neilgherry Hills [a total upwards of 8,000 acres] under the Waste Land Rules of 6th March 1863, as many as 50 have undertaken Chinchona cultivation[390].

Markham then proceeded to the neighbouring Wynaad district, mapping the progress of cinchona cultivation as he travelled (figure 6.13). He describes how he:

> ...rode backwards and forwards over every part of the Wynaad district, examined all the roads...I rode on an average 30 miles a day, under a blazing sun, at a time when fever was raging, for 16 days; and spared no pains to obtain accurate information on all points, by careful personal inspection, and by conversations with Government officials and with planters.[391]

His resulting map (figure 6.12), was presented at a meeting of council (probably of the Hakluyt Society)[392] on November 12th the same year.[393] As Folke recognised, this map is, "A unique source of information about the extent and location at that time of plantations in the Nilgiris and adjoining areas...an outstanding, but

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389 Extract of a letter from Markham to the Under Secretary of State for India, dated Guindy Park, Madras, 14th February 1866. BPP, 1866: 188.
390 *Ibid.*
391 *Ibid.* p.189.
392 Markham was an active member of the Hakluyt Society contributing several publications, although no mention of the map is made in the 1866 report. See: http://dsr.nii.ac.jp/toyobunko/III-2-F-b-2/V-1/page/0008.html.en [accessed 16/01/10]. Several of his letters are written on notepaper marked 'Union Club'.
393 Markham to Richard Henry Major, dated 14th October 1866. BL. Eur Mss A.82.

hitherto unnoticed, map" (1966:205),[394] and the only map specifically of the Nilgiri cinchona plantations.

32 plantations cultivating cinchona are marked and named (either alone or as a part of mixed cropping), alongside the name of the proprietor in the majority of cases. The government plantations at Dodabetta and Naduvattam are clearly located, and propagating houses feature at Dodabetta. In Folke's opinion, the accuracy should be questioned, and he is of the opinion that many of the plantations must be either exaggerated in size, or only partly planted up (Folke, 1966). The government plantations covered approximately 500 acres at this time (figure 5.8). The private plantations must also have all been in the very early stages of planting, although once land was prepared and plants obtained, planting up could be a fairly rapid process. The Denison family purchased the Ossington estate in February 1866 (just before Markham surveyed the district), and by December of the following year, manager Charles Denison was able to recount the rapid transformation that had occurred. "In September 1866 we had 2500 cinchona plants and we now have 200,000 and by next September I hope to see 450,000 when the estate will be pretty well planted up."[395] James Money's Deva Shola estate (900 acres in extent)[396] is the largest private cinchona venture marked on the map, a label it retained up until its transfer to tea in 1897, the only private venture with its own propagating house. Mr. Rohde also purchased his estate Balmadie in 1866 "when 31 acres were planted, which in May 1868 was extended to 60 acres."[397] Mr. Rohde's plantation was pictured in the *Illustrated London News* in 1872 (figure 6.11).[398] The men who established names for themselves as successful and pioneering cinchona planters at this early stage would form a respected handful of private cultivators whose sustained efforts would year on year be praised by the Superintendent.

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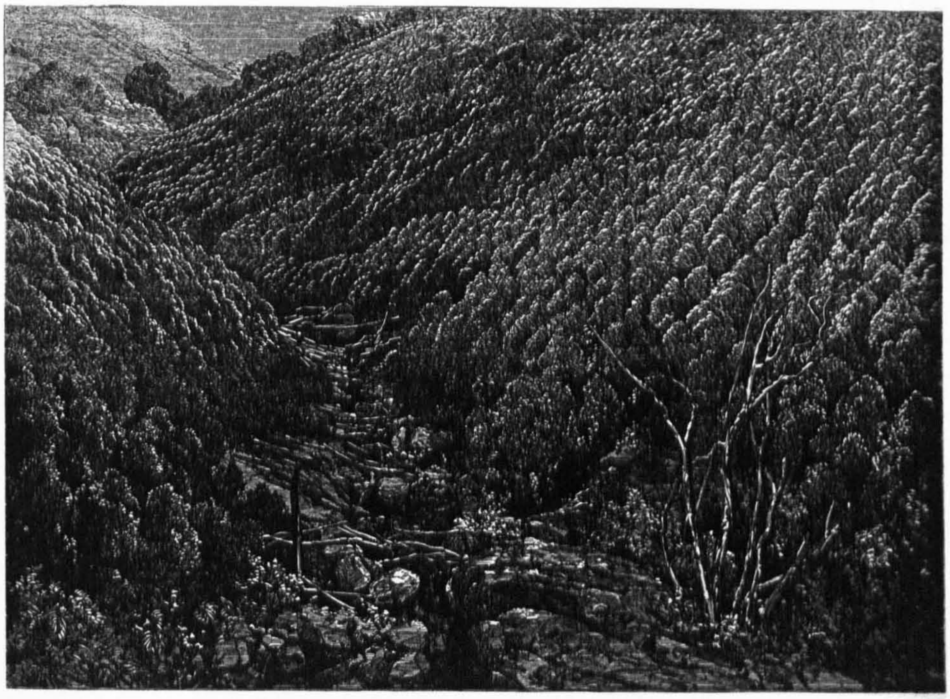
[394] Folke attributes the map to be held at the RGS, but I consulted it at the BLO.
[395] Charles Denison to Evelyn Denison, dated Ootacamund, 21st December 1867. MSCN. OsC907/1-2.
[396] AAR, 1864-65. BPP, 1866:164.
[397] *Statement of Moral and Material Progress and Condition of India, 1872-73*. BPP, 1874:45.
[398] *Ibid.*

Figure 6.11 - Rohde's Cinchona Plantation 'Balmadie'



BALMADIE'S CINCHONA PLANTATION NEAR DOLACAMUND, MADRAS PRESIDENCY.

Source: Anon. (1872a). Indian cinchona plantations. *Illustrated London News*. February 10th 1872:134.

Much more numerous on Markham's map are the coffee plantations, situated on the lower lying plateau (Folke, 1966), dominated by those in the Ouchterlony Valley (figure 6.13). Folke's own investigations of the 1960s revealed that "Many of the old plantations still exist, some yielding the same crop, and some even carrying the same name... While changes of crop and ownership have been numerous, a certain locational inertia has prevailed" (1966:207).

A monetary crisis was experienced in the Nilgiris in the year of Markham's visit, and the following year several private planters were forced to dispose of their plantations as a result of limited means, not able to meet the annual rent of two rupees per acre charged for forestlands on the hills.

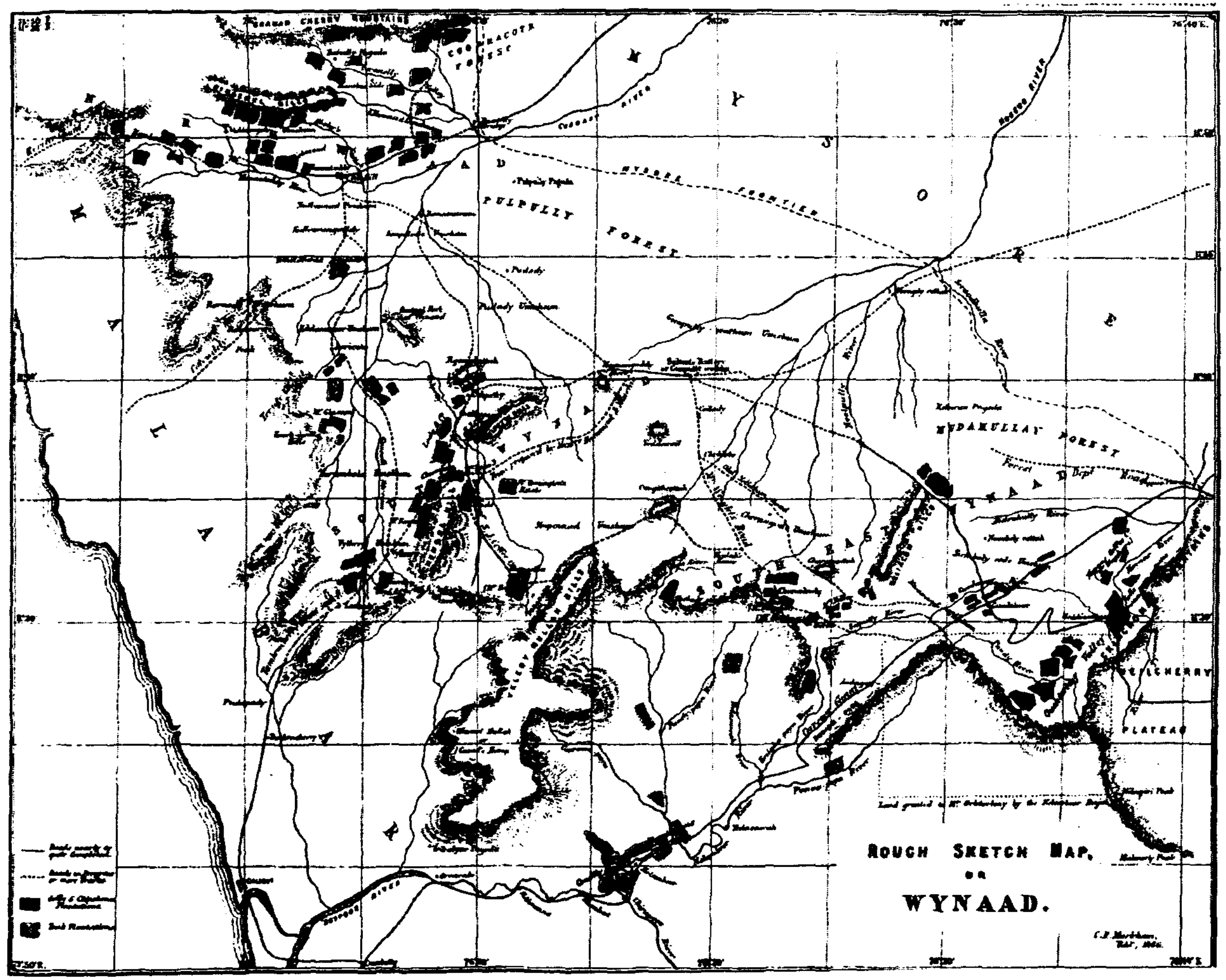
> Some of the planters, however, have made rapid strides with their cultivation; among the most promising plantations are those of Mr. Money, Colonel Denison, Mr. Rohde, Major and Mr. Morgan, and Captain Jennings; these plantations are all in a very promising condition, and if carried on with the same perseverance will, in a few years, add to the exports of India a large supply of 'Peruvian bark.'[399]

[399] AAR, 1866-1867. BPP, 1870:124.

Figure 6.12 – Map of the Neilgherries, Koondahs, and the Wynaad to Illustrate the Progress of Chinchona Cultivation up to July, 1866 by Clements R. Markham

Source: BLO. Maps. D10:25 (10). The cinchona plantations are shaded green. The government plantation at Dodabetta is approximately in the centre of the right hand side of the map, with the Naduvattam plantation to the north-west, and Mr. Money's Deva Shola plantation to the south.

Figure 6.13 - Cinchona Plantations in the Wynaad, 1866 by Markham



Source: Report on the coffee-planting district of Wynaad, February 1866 by Clements Markham. BPP, 1870: facing 82. This 'rough sketch map' was a precursor to the larger map pictured in figure 6.12.

For many of the cinchona planters in the Nilgiris, their home was also their place of work and scientific knowledge production (certainly for McIvor who is said to have lived on the boundary of the Dodabetta plantation, see figure 3.11). Shapin points out that "certain observations, particularly in the natural history sciences but also in experimental science, could, for instance, be made only by geographically privileged persons" (1988:375). Ocular testimony was essential to knowledge making, and credibility was particularly acute in the field, "where on-the-spot verification was so often impossible. However it was defined, the field was necessarily a more open and diffuse space than the study or the laboratory, and it was inhabited by a wide range of people practicing different kinds of observation" (Driver, 2000:268). European overseers resided on each of the government plantations, although the apparent isolation could be difficult to cope with (see chapter 7).

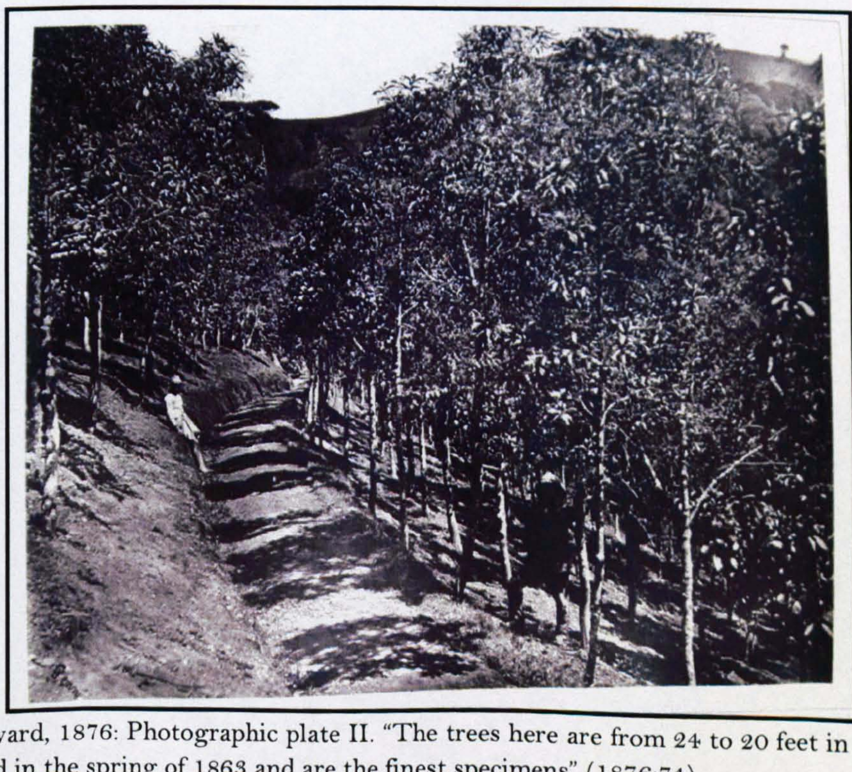
There was still no recognised general agency for conducting negotiations concerned with the sale and purchase of property on the hills, and it continued to be the case, that, "when estates are advertised for sale, they are often regarded with suspicion, and the value of them is reduced in consequence, or the owner is looked upon, from the mere fact of his advertising his property as for sale, as being in difficulties and therefore to be taken advantage of."[400] Even the government could not sell their unwanted plantations (see chapter 5).

[400] BL. *SIO*. 8th October 1879. p.6, col. A-B.

Figure 6.14 - *Cinchona succirubra.* Planted in 1862. First Denison Plantation Naduvattam – View on the main road. Elevation 6,200 feet.

Source: Howard, 1876: Photographic plate I. The trees are from 34 to 40 feet in height. "The mossing to which they have been subjected is very apparent. From these trees five harvests of bark have been collected – the present from 1,000 trees giving 2,500 lbs. of bark… still in fine health and growing vigorously" (1876:74).

Figure 6.15 - *Cinchona officinalis.* Planted in 1863. Dodabetta Plantation, Ootacamund – View on the main road. Elevation 7,800 feet.



Source: Howard, 1876: Photographic plate II. "The trees here are from 24 to 20 feet in height. They were planted in the spring of 1863 and are the finest specimens" (1876:74).

In its brief period of prominence, cinchona plantation science had a distinctive regional character, the Nilgiri plantations pitched against those in Darjeeling and elsewhere in the British Empire, Superintendent against Superintendent, Cinchona Department against Cinchona Department, and Presidency against Presidency. Growth comparisons between Nilgiri and Darjeeling plants were made, and the favourable results celebrated by those in the Nilgiri camp. This supports Naylor's consensus on regional science, "Whilst differences were assuredly there, what is perhaps most interesting for historians and historical geographers is the attempt by regional scientists to distinguish themselves from others working elsewhere, whilst tempering their claims to distinctiveness with assertions that their work was of national significance" (2005b:7). The cinchona plantations, particularly those belonging to government (figures 6.14 and 6.15) were also viewed on an international scale, with empire pitched against empire. As Naylor explains more broadly, "States have used science both to understand and to intervene in the affairs of the nation, as well as to engage in geopolitical struggles with their competitors, whether that be in an intellectually competitive way or to help them gain economic, political or military advantage over others" (2005b:8). The government plantations survived well into the twentieth century, covering an area of 528 acres when Folke surveyed the region in 1964 (1966:208).

6.3.2 Cultivating and Harvesting

As Barron acknowledges, "The claim to scientific superiority, like the claim to moral superiority, offers a challenge to the imperial historian... the nineteenth-century empire-builder may well have been apprised of the latest scientific knowledge of his day, but would that 'scientific knowledge' pass muster now?"(1987:6). This makes the notion of the superiority of European science in plantation agriculture problematic. Barron's own study begins by drawing attention to the very lack of agricultural scientific expertise possessed by the first generation of European planters in Ceylon, a characteristic revealed to an extent by their previous occupations:

> William Boyd, for example, one of the best known of the early planters, listed his agrarian neighbours in 1842 as a retired Captain of the Bombay Marine, a lecturer in anatomy from 'the College at Edinburgh', a captain of the line, an editor of a newspaper, a bank clerk, an Aberdeen farm servant, a reverend Doctor of Divinity, and an English barrister (Barron, 1987:7).

In contrast, in a study of indigo plantations, Kumar found that far from being "hostile to science" or "anti-scientific" (2007:4-5), in reality, when cheaper and purer synthetic indigo came onto the international market in 1897, "planting interests feared a threat to their capital and disruption of their settled lives" (2007:3), and set about presenting a strong defence of the natural dye involving a sophisticated programme of scientific improvement. Kumar presents the agricultural classes as "consistent patrons of science" (2007:28), and aims to recover, "planters and their indigo science from the obscurity into which they have fallen since the transition to synthetic colourants" (2007:5). In a similar vein, the importance of private planters in facilitating cinchona science should not be ignored, as Beinart and Middleton explain, "Companies, settlers and plantation owners, rather than the state or scientists, often took the initiative in institutional development ...private plant collectors collected the best cinchona seed..." (2004:13).

Cinchona planters had very few people to model themselves on given the newness of the cultivation, although some did have prior experience with other plantation crops like tea and coffee to draw upon, and in many cases they continued to grow these crops alongside the new tree, as a kind of insurance measure. This was a time when plantation agriculture was evolving rapidly. "The creation of a Forestry Department in Madras Presidency in 1847 and the appointment of a Conservator of Forests in 1858 also led to experimental farms and advice on appropriate plantings" (Sharrad, 2007:41). Others were new entrants to the industry, caught up in the hype surrounding the fever bark. The difficulties of cultivating in the absence of a sound knowledge of cinchona cultivation and quinology should not be underestimated, and a high degree of confusion reigned throughout the course of the experiment.

Driver suggests we think of geographical knowledge as, "constituted through a range of embodied practices – practices of travelling, dwelling, seeing, collecting, recording, and narrating" (2000:267). In this way we can view the Nilgiri cinchona planters as geographers engaging in 'field-work', slowly getting to know their plantations and the habits of their plants. However, we should remember that these planters were speculators, who sought profits over agricultural perfection (Barron, 1987). The cinchonas were unpredictable, and the environment not readily controlled (see chapter 7). Still, fieldwork conducted by private planters had the potential to unsettle the authority of dominant views (Driver, 2000). Cinchona growing blurred the line between amateur and professional, as it also did between gardener and botanist. As Barron explores for Ceylonese coffee estates, "Much was still thought open to trial; and on fundamental points… the authorities admitted that practice varied. Much therefore was still considered unknown" (1987:11).

One cinchona planter stands out from the rest as being an ambitious experimenter – Mr. James William Bayley Money, a man with particularly good connections to Java where the Dutch cinchona experiment was based "…he, several years since, having published a book on its political and agricultural systems."[401] In it, he noted,

> A very important article of future commerce has been lately introduced into Java by Government in the *Cinchona Calisaya*, from which the best quinine is made… Should they [the seeds recently obtained from the plants] succeed, as there is every reason to expect, a few years will enable Java to supply the East at a low rate with this invaluable medicine in high perfection, and in quantities only limited by the demand (Money, 1861:175-176).

A Calcutta barrister by training, Money visited the Dutch plantations on several occasions (including a joint trip with Campbell Walker in 1878)[402] and experimented with the 'scraping' method of removing the bark advocated by the Dutch. He was also the man who brought the prized *Cinchona ledgeriana* seed to the Nilgiris, giving some of his parcel to McIvor in exchange for a parcel of another variety (King, 1876). Money was also a regular contributor to the *SIO*, sending letters to the Editor on cinchona matters, and setting the record straight on the reasons for the record bark prices of 1877, speaking out as an authority in the absence of an official Superintendent. During the year 1878, Money was supplied with 100lbs of green bark from the government plantations for an experiment in drying at Coimbatore.[403] Other Nilgiri planters eagerly anticipated the results of his

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[401] BL. *SIO*. 16th August 1879. p.7, col. C.
[402] BL. *SIO*. 16th August 1879. p.7, col. C.
[403] Revenue Reports. Barlow (Commissioner) to Master (Secretary to Government), dated 5th October 1878. p.3. RBGK. MRMC, 1861-85.

experiments. But not everyone approved of his activities and in March 1879 he was accused of polluting a nearby valley.[404] Much like Kumar's findings, "While it is likely that a few 'charlatans' made false claims to scientific ingenuity in a situation where none could offer a conclusive opinion, other measures suggested did seem worthwhile" (2007:11). Money later became involved with the Nilgiri Chinchona Company, one of very few successful limited companies with cinchona interests, and the largest private owner of cinchona land in 1878 (Anon, 1878b).

Captain Cox's Estate at Cherambaddy was also a site of experimentation as the *SIO* declared in 1880. "Indeed on this estate, 'Naiken Shola', it may be said more has been done to push forward cinchona enterprise – and especially to show the planters of Wynaad what can be attained by plodding perseverance – than all the Government plantations in India."[405]

Most planters obtained their initial stock from McIvor at the Government Gardens, but it wasn't long before other sources became available, stock from Java (and in particular the *ledgeriana* variety) becoming increasingly sought after, and more widely available. The availability of a greater number of varieties gave planters increased room to experiment. In an exact mirroring of the cinchona experiment, Kumar describes how, "By the middle of 1903 the Dalsingserai experimenters...were confirming that Java indigo (*I. arrecta*) was capable of consistently giving a fifty per cent higher yield than the native variety (*I. tinctoria*)..." (2007:18-19). Kumar also outlines the impetus for scientific improvement emanating from all parties,

[404] "The villagers and estates in the Alladu valley are without water. The Alladu stream from which they are supplied in so muddy, as to be unfit for use. The pollution is caused by operations going on in the Deva Shola cinchona plantation, belonging to Mr. Money... The grievance increases with the continuation of the drought, and gradually diminishing flow of water in the stream... How is it that a planter can make free with a necessary of life in this way?... Cinchona is intended to alleviate human sufferings, but there is little philanthropy shown here." BL. *SIO*. 15th March 1879. p.7, col. C.

[405] BL. *SIO*. 6th November 1880. p.6, col.A-B. Captain Cox had previously offered to accompany government cinchonas from Kew to the Nilgiris.

> ...the science of indigo improvement developed through the economic, political and professional self-interest of many actors: planters seeking to maximize profits and maintain the viability of their industry in the face of a new technological challenger; colonial administrators intent on finding a balance between support to the indigo industry and overall agricultural development; and professional scientists keen to explore challenging issues in the chemistry of indigo production, in fermentation and in plant breeding. The indigo science resulting at these colonial stations genuinely reflected these underlying tensions and their fundamental unity (2007:27-28).

Likewise there were plenty of underlying tensions in the Nilgiri cinchona community (see below), but all parties were ultimately interested in the scientific improvement of the crop, signaled by increased percentages of alkaloid content.

After investigating the basic needs of the cinchona in terms of location, aspect, water and shade, the most thorough government experimentation revolved around two subjects; the application of manure, with substantial trials conducted with a number of substances, including: guana, sulphate of ammonia and stable manure to ascertain their effects upon the secretion of alkaloids,[406] and the method of harvesting the bark.

Harvesting the bark was an experimental and labour intensive process requiring great skill. McIvor's initial idea was to encourage the trees to branch as near to the ground as possible, and then cut off alternate branches from year to year, allowing the tree to throw out fresh shoots,[407] but a major drawback of this system was the lower prices attained by quill bark (that obtained from branches) compared to trunk bark.[408] Accordingly, he came up with a new technique, which became known as 'mossing' whereby alternate strips of bark were removed from the tree, which was then wrapped in moss to protect the wounds and encourage the bark to regenerate (figures 6.16 and 7.2).

[406] AAR, 1869-1870. BPP, 1875:5. These manures had been ordered from England, see letter from Government Quinologist to Officiating Chief Secretary to Government, dated 7th March 1872. BPP, 1875:68.
[407] McIvor to Sim, Secretary to Government, Madras, dated 12th March 1862. BPP, 1863:175.
[408] *Ibid.* p.176.

> A labourer proceeds to an eight-year old tree, and, reaching up as far as he can, makes a horizontal incision of the required width. From this process either end of this incision he runs a vertical incision to the ground, and then, carefully raising with his knife the bark at the horizontal incision until he can seize with his fingers, he strips off the bark to the ground and cuts it off. The strip of bark then presents the appearance of a ribbon more or less long. Supposing the tree to be of 28 inches in circumference, the labourer will take nine of the above ribbons... As soon as he has removed his strips, the labourer will proceed to moss the trunk all round, tying on the moss with some fibre... The mere exclusion of light and air from a stem partially bared of bark acts in two ways: it enables a healing process to be rapidly set up...and it has this further curious effect it increases the secretion of Quinine in the bark renewed under its protection (McIvor 1873 reproduced in King, 1880:58).

This process understandably required skilled and supervised labour (visible in figure 7.2), and over time appeared to steadily reduce the health of the tree. It failed completely in the Sikkim plantations due to attack from ants (King, 1880). Happily McIvor also noted that the mossed or renewed trees (so called because the stripped sections renewed their bark covering) attained an extraordinary thickness of bark in a short period of growth. Howard found McIvor's mossed specimens in excellent condition, their commercial value (determined by the quantities of crystallisable sulphates) comparing favourably with the barks of South America. McIvor even tried (unsuccessfully) to patent the mossing process.[409]

Although McIvor reported positive results, others were not convinced of the merits of mossing and proposed alternatives such as coppicing (the leading proponent being Broughton) or shaving (practiced in Java and the private Nilgiri planter Mr. Money). Coppicing was and remains a popular woodland management tool and is described here by George King:

> This consists in cutting down trees either close to the ground or within a short distance of it, and of allowing one or more of the crop of shoots which rises from the stumps to grow...the trees in a piece of forest may be cut down all at once; or a proportion only may be felled, leaving the young shoots originating from their stumps to grow under the protection of the larger trees left standing (King, 1880:81).

McIvor and Broughton could not reach an agreement on the best method of harvesting the bark and on the 26th September 1873, the government issued orders

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409 Secretary of State for India to the Government of Madras, dated 16th June 1866. BPP, 1866:210.

to Dr. Bidie to report on, "...the present appearance of the Cinchona Plantations, and of the respective merits of the 'mossing' and 'coppicing' systems of treating the trees, including of course remarks upon the apparent effect upon the trees of the partial removal of bark..."[410] At Kilgraston, Bidie was able to observe "a very interesting experiment in barking + mossing the trees."[411] This is one of the only descriptions of people actually working the plantations, and so is worth quoting in full. The trees were *Cinchona succirubras* of seven years old, from which one harvest of bark had been removed the previous year, the remaining strips of original bark now to be removed after a year under moss. Two gangs were employed, each comprised of two peelers or barkers, two mossers and one man to gather up the bundles of bark and tie them together.

> The two barkers of each gang work together on opposite sides of the tree, + as soon as they have removed the strips the 2 mossers set to work. If the moss be old or dry it is first [...] + then one man taking up a small bundle wraps it round the tree about a foot above the upper edge of the newly cut surface. The second mosser then takes a ball of [...] and passing this round + round the tree fastens it on. As soon as this is secured another portion of moss is applied to the tree + so on, from above downwards, till the whole of the denunded portion of the stem is covered... The men work ten hours a day so that 10 men would strip + moss 100 trees per diem. Then each man gets 4 annas of daily pay... To this has to be added the cost of the moss which is yearly getting scarcer or at any rate has to be brought from a greater distance. A coolie brings two bundles of moss per diem so that each bundle is said as an average to be sufficient for 3 trees... This added to the cost of stripping and labour gives a total charge per tree of 1 anna 0.8 pie. The yield of green bark from the 10 trees, the strips being detached from the height of 6ft downwards was 23½ lbs. The probable yield from 100 trees would thus be 235lbs...[412]

Bidie's notebook of observations did not lead to a resolution of the debate, but the subsequent report did seem to push government towards favouring the coppicing process.

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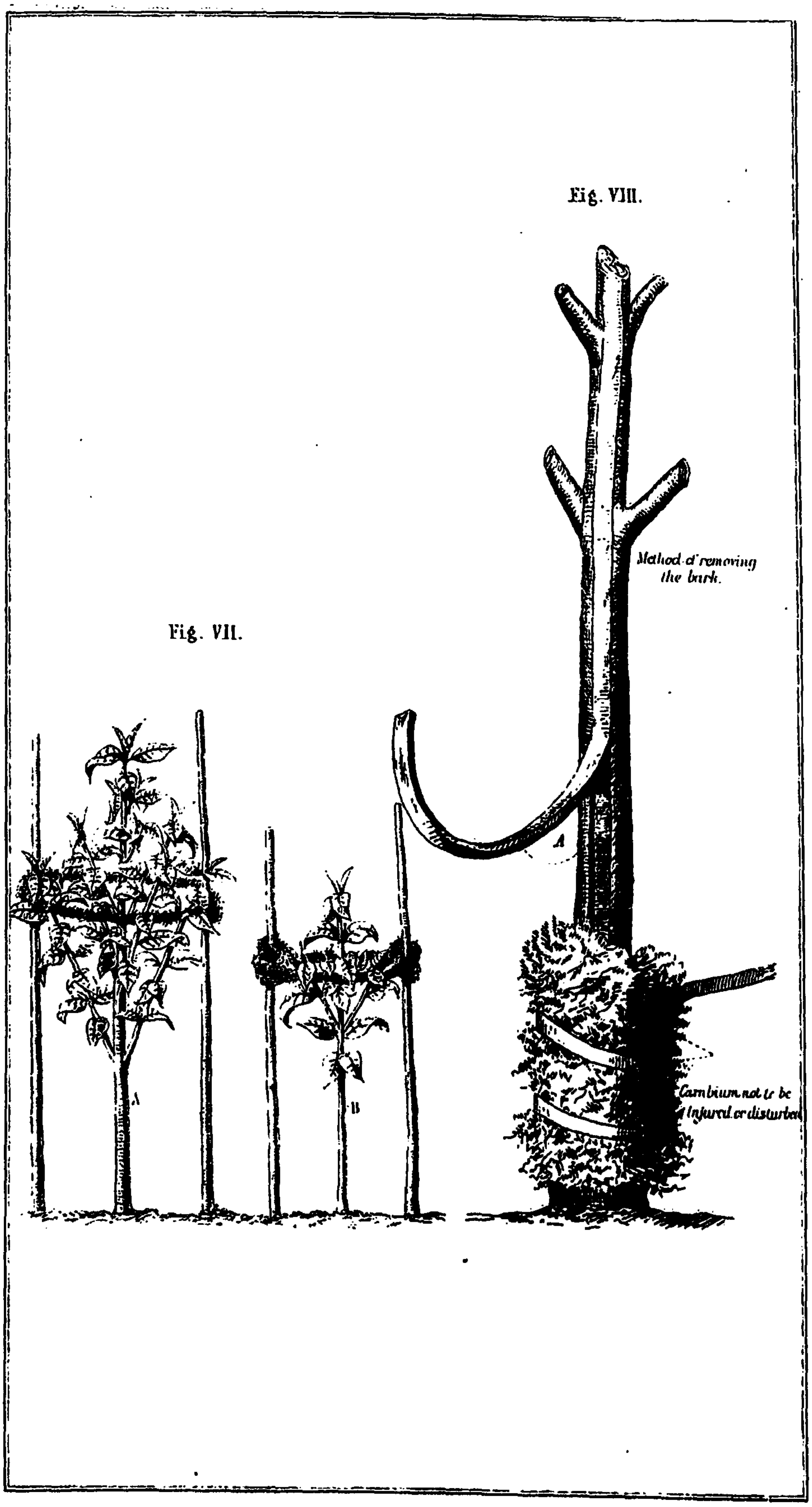
410 R.M. Dalyell, Assistant Secretary to Government, to G. Bidie, dated 26th September 1873[?]. RBGK. JEH/1/47.
411 Bidie's notebook. RBGK. JEH/1/47.
412 Bidie's notebook. RBGK. JEH/1/47.

Figure 6.16 - McIvor's Mossing Process



Source: AAR, 1864–1865. BPP, 1866:170.

On the 2nd August 1875 McIvor wrote an extremely lengthy letter, complete with detailed footnotes to J.R. Cockerill, Commissioner of the Nilgiris. His purpose was to respond to the recent despatch from the Secretary of State, and endorsed by Cockerill, in which the Right Hon'ble had written, "I shall be glad to be informed why so early as in July 1871, the supply of bark for the alkaloids manufactory was ordered to be obtained by mossing, while contrary to the advice of the Quinologist the coppicing system has been tried to so small an extent."[413] McIvor explains how early results from coppicing (240 trees of *Cinchona succirubra* felled in 1871), had been so unsatisfactory that in a meeting between himself, the Commissioner and Broughton, further felling had been disallowed and coppicing postponed for at least two more years.

> Had we coppiced in 1871 by the end of 1872, every tree on the plantations which had reached productiveness would have fallen under the axe to supply the bark required by the Quinologist alone. As to mossing, it possesses one feature in common with all the plans I have recommended; it may be condemned but it must be practiced.[414]

He remained convinced that mossing could produce from 30 to 40 times the quantity of bark that could be obtained by coppicing, coppiced trees yielding a crop every eight to ten years whilst mossed trees yielded an ever increasing crop annually. Renewed bark produced under moss also had a higher market value, and was more cheaply collected and transported (owing to it being much lighter). Writing this letter, McIvor had reached boiling point, openly venting his anger at the continual attacks against his methods of cultivation,

> The discovery of mossing, is therefore, one of the most important I have made in this cultivation. It is destined to convey the blessing of health to millions. Yet, what a misfortune has it been to myself. The promulgation of this discovery in 1866, raised against me a storm of opposition, which has blighted my prospects ever since.[415]

He signs off ominously, "I feel that this is probably the last exertion I may be able to make in the interests of an undertaking, in which I have laboured so zealously

[413] G.O. dated 1st April 1875, No 501. Referred to in a letter from McIvor to Cockerill, dated 2nd August 1875. RBGK. JEH/2/3.
[414] McIvor to Cockerill, dated 2nd August 1875. RBGK. JEH/2/3.
[415] *Ibid.*

and to which I have devoted the best years of my life."[416] True to word, this did prove to be one of McIvor's last exertions, as he died on June 8th 1876. The debate between coppicing and mossing would continue long after McIvor's death and Broughton's disappearance, although the mossing process slowly gained widespread acceptance after good results in the auction.

As Barron (1987) acknowledges, cinchona required more technological skill than coffee, particularly when it came to processing, the method of turning the raw bark into effective febrifuge another area requiring experimentation, this time in the laboratory and factory.

6.4 The Laboratory and Factory

Just having cinchonas growing on the Nilgiris (even in large numbers) was not enough to declare the experiment a success, as it was quinine which was the desperately sought after prize. The bark would take time to mature and would then be subjected to new scientific investigations and processing in the laboratory and factory. These were two spaces that were physically close to one another on the Naduvattum site, and which were both under the direction of the Quinologist.

In 1988 in an examination of the spaces of science, Sturchio, noted that: "In particular, the laboratory as a privileged space for doing science is becoming an important locus for historical inquiry, and the artifacts used by scientists in the past are now seen as useful tools for examining the changing conduct of scientific work" (1988:369). Similarly, Anderson's contention is that in the nineteenth century, "increasingly the laboratory was called on to authenticate knowledge" (Anderson, 1992b:508). This was certainly the case for Nilgiri cinchona; where bark samples were sent for analysis to laboratories on site, back in London and on occasions to laboratories elsewhere in Europe. It was in the laboratory where the quality of the bark was determined and its value assigned, and it was important in which laboratory and by which Quinologist this process occurred.

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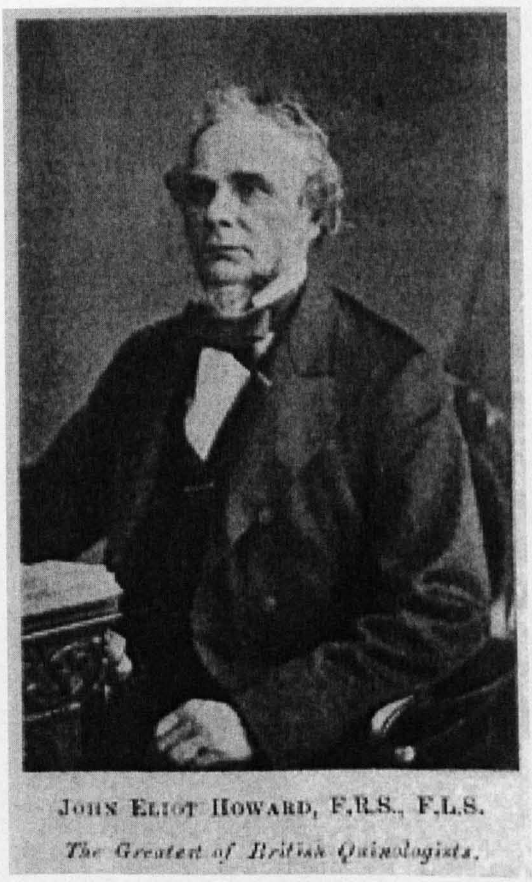
[416] *Ibid.*

6.4.1 Classification and Quinological Analysis

The first role for the laboratory was to correctly identify the varieties of cinchona growing on the Nilgiris and to make a judgment on the value of their bark in terms of alkaloid content. In the absence of a laboratory on the Nilgiris, in the early years dispatches of bark were sent to the laboratory of John Eliot Howard in London (figure 6.17). As a Quinologist, Howard was highly respected, his work highly regarded as authoritative (demonstrated by his place in the jury of the botanical congress in 1877, figure 6.18). *The Pharmaceutical Journal* named Howard the "front rank among living quinologists", rendering his opinion on all questions connected with the subject, "of the greatest value and importance."[417] His analyses (if favourable) would be seen as a guarantee for the quality of Nilgiri bark in markets around the world.[418]

Figure 6.17 – John Eliot Howard, F.R.S., F.L.S. 'The Greatest of British Quinologists'



Source: Anon, 1903:2. LMA. ACC/1037/801/19.

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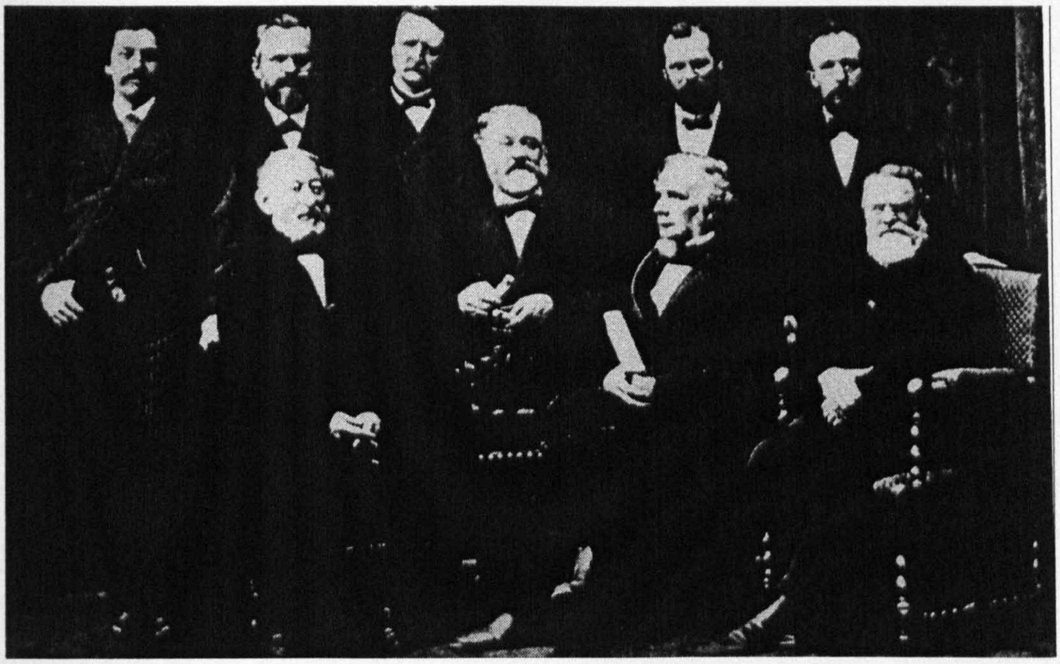
[417] Anon, 1870:658.
[418] McIvor to Secretary to Government, dated 9th May 1867. BPP, 1870:120.

Figure 6.18 – Jury of the International Botanical Conference, Amsterdam, April 1877



Source: LMA. ACC/1037/821. The jury was composed of (left to right), standing; Jul. Jobst (?), G. Kerner, H.A. Weddell, Gust. Planchon, A. J. Rÿk (?), and sitting; Ph. Phoebus, J.E. de Vrÿ, John Eliot Howard, and J.K. Hasskarl.

McIvor thus felt able to report in 1862, "I believe that a doubt cannot be entertained as to the correctness of the names attached to our species, as in many instances the bark of the trees from which the seeds were gathered, and the layers procured, was subjected to analysis, in order to prevent the possibility of mistake."[419] Scientific investigation in the laboratory was assuredly believed to be the key to success, helping the British team to avoid the mistakes made by the Dutch (McIvor, 1862). Confusion, however, reigned over nomenclature throughout the experiment. As Endersby reminds us, "…disputes over names are a useful reminder that scientific names are more than convenient, unambiguous labels" (2001:353).

In April 1863, the samples shipped to Howard included bark from two of the trees planted out by Sir W. Denison and Co which had been cut down for the purpose, dried upon warm iron plates, and then exposed to the sun to complete the process.[420] Even at this early stage in cultivation, Howard's analysis showed unexpectedly that, "the young bark grown in India has yielded as large a per-

[419] AAR, 1861-1862. BPP, 1863:232.
[420] McIvor to Sim, dated 4th April 1863. BPP, 1866:1.

centage of quinine as is usually obtained from the mature bark of the same species received from South America."[421] Laboratory results continued to improve, the third remittance of bark transmitted in March 1864 establishing the fact that cultivation increased the production of febrifuge alkaloids in the plants.[422]

A problem arose in May 1865 when the samples sent to Howard (including two specimens of renewed bark produced by McIvor's mossing process),[423] although showing the Nilgiri barks to be rich in febrifuge alkaloids, as Howard explained, "the crystallisations of quinine are mixed with some sulphate of chinchonidine, which is commercially, but not medicinally, a disadvantage."[424] Howard urged the authorities to attempt to popularise chinchonidine in the medical and commercial worlds – himself believing that chinchonidine must have constituted at least part of the therapeutic agent in the cure of the Countess of Chinchona.

Howard and Sons (prided manufacturers of alkaloids as well as analyists) were subsequently asked to supply sufficient quantities of salts of chinchonidine, quinidine and chinchonine to carry out experiments in India.[425] The members of the Commission to test the efficacy of the cinchona alkaloids other than quinine included Mr. Shaw (Officiating Principal Inspector General, Medical Department) plus three gentlemen with long experience in the treatment of fevers:

> Dr Mackenzie was stationed for many years, in the most feverish districts, in the Hyderabad Division, and is now Deputy Inspector General of the Mysore territory, also a feverish country. Dr Inglis was with his regiment for about 19 years in the Bengal and Bombay Presidencies, and Dr Kennedy has been nearly all his service a regimental officer, the latter seven years of which he was in charge of European Artillery at Kamptee, where fever is scarcely ever absent.[426]

Initial findings were presented in February 1867. 1,145 cases of fever had been treated with either chinchonine, chinchonidine or quinidine, and although doses and modes of administration had varied a good deal through the trial, "The main

421 Charles Wood to the Government of Madras, dated 16th July 1863. BPP, 1866:8.
422 Charles Wood to the Government of Madras, dated 8th August 1864. BPP, 1866:47.
423 McIvor to C.G. Master, Secretary to Government, dated 3rd May 1865. BPP, 1866:122.
424 Charles Wood to the Government of Madras, dated 30th September 1865. BPP, 1866:133.
425 Markham to J.E. Howard dated 20th September 1865. RBGK. JEH/1/12.
426 Officiating Principal Inspector General, Medical Department, to the Secretary to Government, Revenue Department, dated 23rd March 1866. BPP, 1870:6.

conclusion which the Members of the Commission have derived from the data before them, is that the alkaloids hitherto but little valued in medicine, are scarcely, if at all, inferior as therapeutical agents to quinine."[427] The Secretary of State then, "directed copies of the report to be furnished to leading physicians and chemists in Great Britain and on the continent,"[428] in an attempt to make the results widely known and to safeguard the reputation of Nilgiri bark.

Laboratory analysis produced definitive facts but could take several months to obtain owing to the vast distance that separated the plantations from the laboratory. Government was keen to speed up the process, appointing an "analytical chymist" who arrived at Ootacamund in June 1867, appointed for a term of three years on a salary of 1,000*l.* per annum, with an additional allowance of 200*l* for the provision of the necessary apparatus and chemicals, which would be shipped for transmission round the Cape (Anon, 1867b). Recommended by Dr. Frankland from the Royal Institution, Mr. John Broughton was, "already acquainted with the chemistry of the chinchona plant,"[429] and his task would be to "...investigate the causes which regulate the yield of alkaloids from cultivated chinchona barks, and to ascertain the preparation of the febrifuge which will combine cheapness with efficacy in the greatest degree."[430]

Regarding the site of the laboratory, we know that Broughton, "in conjunction with Mr. McIvor, provisionally selected a very suitable site in an inconspicuous and, at present, uncultivated part of the Botanic Gardens, and adjoining their boundary."[431] Plans were approved at an estimated cost of 6,500 rupees.[432] It seems likely that the Quinologist was largely given a free reign over his equipment, activities and laboratory space. In the process by which, "...science itself creates spaces and places for its own activities and in turn spatializes the world in a wide variety of ways" (Naylor, 2005b:3), the Quinologists laboratory is a good example. This was a new science, needing a new type of scientist who in turn required new spaces in which to work.

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[427] President and Members of the Chinchona Commission to the Secretary to Government, Revenue Department, dated 28th February 1867. BPP, 1870:108.
[428] Secretary of State for India to the Government of Madras, dated 24th May 1867. BPP, 1870:115.
[429] Secretary of State for India to the Government of Madras, dated 17th October 1866. BPP, 1870:3.
[430] Under Secretary of State for India to Broughton, dated 22nd September 1866. BPP, 1870:4.
[431] Broughton to the Secretary to Government, Revenue Department, dated 29th January 1867. BPP, 1870:114.
[432] Order of the Madras Government, dated 23rd February 1867. BPP, 1870:115.

Broughton's first report on the Neilgherry cinchonas, dated 1st April 1867, was published in the *Pharmaceutical Journal* of November 1867 (Broughton, 1867).[433] In it he described how his initial examinations had been "conducted under considerable difficulties, arising from the want of many of the chemical appliances which are requisite for the analysis of cinchona barks" (Broughton, 1867:239). The greater part of his studies to date had concentrated on the *Cinchona succirubra* (red bark), the species demonstrating the most vigourous growth in the Nilgiris, and the most important numerically, with 800,000 plants growing in the various plantations. It would, therefore, be *Cinchona succirubra* bark that would be harvested and consumed first. Broughton described how even the poorest sample he'd analysed had still given an alkaloid yield at least equal to the best Ecuadorian red barks (Broughton, 1867). In these initial investigations he also recognised the mossing system of removing the bark from the tree (higher alkaloids derived by depriving the bark of exposure to light, and not to protect from oxidation as some thought),[434] as possessing advantages, and noted the probable worthlessness of the cinchona leaves as a source of febrifuge alkaloids.

Positive analyses by Howard and Broughton were still not enough for government and the following year (1868), a box containing samples of Nilgiri cinchona bark and seeds were transmitted to Monsieur Delondre in Paris, "in order that the true value of our chinchona barks may be confirmed on the Continent by analysis and report of eminent French chemists."[435] McIvor was now confident that laboratory analysis performed anywhere in the world would acknowledge the value of the Nilgiri barks. Broughton's onsite investigations were deemed to be of great value to Government as the Secretary of State explained in January 1872, "not only is much time saved, but errors are avoided, and in the end considerable saving in actual outlay is doubtless effected."[436] Results were widely distributed to the Governments of the other Indian Presidencies, Ceylon, the Straits Settlements, Batavia and the French settlements in India.[437]

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433 The quinologist's report then became an important addition to the AAR.
434 The injurious action of light on cinchona bark and alkaloids had been pointed out by the chemist Pasteur. "I would submit that the foregoing facts and considerations render it highly probable that the exposure of the *living* bark to direct sunlight has the effect in diminishing the yield in alkaloids, and hence the advantage of direct protection". In Broughton, 1867:241-2.
435 McIvor to Secretary to Government, Revenue Department, dated 5th June 1868. BPP, 1870:155.
436 Secretary of State for India to the Government of Madras, dated 11th January 1872. BPP, 1875:49.
437 Order of the Madras Government, dated 26th September 1871. BPP, 1875:49.

Broughton's paper 'Chemical and Physiological Experiments on Living Cinchonae' published in the *Philosophical Transactions of the Royal Society of London* in 1871, illustrates the variety of scientific investigations he performed. There were now three million cinchona trees of various species on the Nilgiris, the greater part of which were on government plantations, and Broughton had now completed three years of chemical investigations on the spot commenting that, "the living plants have never before been under the control of the experimenter" (Broughton, 1871:1). He now placed the cinchona alkaloids in two groups relating to their efficacy; "1st Quinine, Cinchonidine, Quinidine; 2nd. Cinchonine" (1871:2). The largest yield of quinine of any kind ever known (9.75%) had recently been found among some plants raised from seed brought by Cross from the Loja district, but was of a kind where species or variety was not accurately determined. New analyses had confirmed that cinchona leaves were useless as a source of alkaloids, and Broughton had also analysed the flowers, fruit, wood, seed and fluid of the trees, and investigated the impact on alkaloid content of exposure to sunshine during the drying process.

Broughton also made use of the laboratory's position in the 'field'. For example, in a more in-depth consideration of McIvor's mossing process, Broughton had covered the trunk bark of two trees of *Cinchona succirubra* for ten months, one with a shield of tin, and the other with a double fold of black alpaca cloth – keeping the bark in darkness, whilst not impeding the flow of air. In both cases the amount of alkaloids was increased, although quinine had not shared in the increase – a consequence that Broughton was "not prepared to find" (1871:10). As the nature of the soil on which the trees were grown was on the whole similar, experiments on the effects of soil type were more difficult to obtain, and application of lime around several trees had not so far appeared to have any effect on alkaloid yield (1871:14–15).

Like Broughton, Howard also took his investigations outside of the laboratory; cultivating cinchonas in his greenhouse at home in Tottenham (figure 6.19) in the belief that living plants offered greater potential for observation than dried specimens. In the *Pharmaceutical Journal* of January 1870 he published a paper entitled, 'On the Cultivation of Cinchona Plants under Glass in England', in which he claimed ten years experience of cinchona growing, "...during the larger portion of which my experiments have been carried on in a conservatory which I had constructed for the purpose, and which, though on quite a limited scale, enables me to estimate what might be done by means of the appliances at the disposal of the directors of our botanic gardens" (1870:1). Howard had observed variation between the children of one parent plant, and the influence of light (deficiency in the English winter and excess in summer), soil, water (cinchonae impatient of water at the roots), and nutrition, upon growth. For Howard, experience in cultivation meant the formation of "real *science* which meant *knowledge,* and not *speculation*" (1870:4).

Figure 6.19 – *Cinchona calisaya,* var. *angelica,* growing at J.E. Howard's Home, Lord's Meade, Tottenham, 1879

Cinchona Calisaya, var. Anglica
Lord's Meade, Tottenham
J E Howard. 1879.

Source: RBGK. No reference.[438]

[438] Also see a set of three photographs depicting cinchonas growing at Howard's home between 1865 and 1881 in WL. PHO. No.9554.

Hooper sprang into action when he took up the Quinologist's position in 1884.

> I arrived at Madras on the 6th October 1884 and proceeded to Ootacamund. A building had been provided for me, which, after certain adaptations and fixtures made in it, became converted into a moderately efficient laboratory. The chemicals and apparatus which I had used in the special study at The Hague were brought out with me; I was therefore able to commence work about a fortnight after arrival...[439]

The Nilgiri plantations had been without a Quinologist for ten years, and all of Broughton's equipment sold off:

> Tools, Machinery and other Apparatus, Belonging to the Government Chinchona and the late Quinologist's Departments, will be sold by Public Auction, At the laboratory, near the Government Garden Gates, Ootacamund, on Monday the 26th Sept 1881, and following days commencing at 12 noon...[440]

Now in the hills, Hooper also spent time in the field describing how, "When samples are taken for analysis from trees in the Government Cinchona Plantations, I have always endeavoured to be present, so that observations as to situation, soil and habit of the trees might be noted..."[441]

Contrary to popular belief, both resident Quinologists also investigated the medical potential of plants native to India, which included possible alternatives to cinchona. During a tour of the district in early 1868, Broughton managed to obtain specimens of native febrifuges, the most promising of which he intended to submit to chemical examination, whenever his more direct duties permitted.[442] The March 1868 edition of the *Pharmaceutical Journal* included a report from Broughton, 'On a false cinchona bark of India' (Broughton, 1868).[443] As Anderson explains, "The modern scientific paper was the typical genre of the laboratory, regardless of location" (1992b:517), the output requiring specialist skills and knowledge of rules. By publishing in them, Broughton and his successor Hooper, were attempting to broaden the local scope of their observations. "The scientific paper derives its power and interest from the

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439 BL. *SIO.* 14th November 1885. p.10, col. B to p.11, col. A.
440 BL. *SIO.* 17th September 1881. p. 1 col. D.
441 BL. *SIO.* 14th November 1885. p.10, col. B to p.11, col. A.
442 Broughton to Secretary to Government, dated 4th April 1868. BPP, 1870:152.
443 Broughton's report on this bark can also be found in: Letter from Broughton to Acting Secretary to Government, Revenue Department, dated 6th June 1870. BPP, 1870:247.

attempt to disguise the many negotiations that were required in the field for a scientist to generate such a text. It attempts to speak outside the social and historical situation in which it was created..." (Anderson, 1992b:521).

The laboratory very much belonged to the Quinologist, and the reports make only one mention of the presence of an assistant. Shapin's study of seventeenth century laboratories, also described a lone laboratory worker. As Shapin explains, "Solitude is a state that symbolically expresses direct engagement with the sources of knowledge – divine and transcendent or natural and empirical. At the same time, solitude publically expresses disengagement from society, identified as a set of conventions and concerns which act to corrupt knowledge" (1991:191). Whether Broughton was in or outside of Nilgiri society is perhaps another question that should be asked. Shapin decides of his scientist, "At the point of securing their knowledge, they are said to be outside the society to which they mundanely belong. And when they are being most authentically intellectual agents, they are said to be most purely alone. The social place of knowledge is nowhere" (1991:192). Similarly, Kohler declares that laboratories aspire to be "places apart from the world – placeless places" (2002:91). Likewise, "Livingstone argues that the laboratory has come to epitomize the scientific success story precisely because it lacks any local connotations, for as he reminds us, it is now commonly held that any science that is local has got to have something wrong with it" (Naylor, 2005b:2).

Shortly after Hooper had been appointed, he was directed to undertake the analysis of private bark, alongside his current commitments. A couple of firms offering the analysis of bark also opened up on the Nilgiris during the 1880s. Analyses of government and private bark would be made public before the auction date. This seemingly placed the power in the buyers' hands, but in August 1871 Broughton had suggested that unfavourable analyses could be manipulated.

> As at the present time the prices of chinchona bark in English market are high, I should strongly recommend that the bark be sent via Suez Canal, in order to avoid delay. The Government will, of course, do as is considered best about making the analyses of the barks known before sale. But of the red barks I should certainly recommend that only the amounts of "Total alkaloids" and "Total sulphates, excluding chinchonine" be made known.[444]

[444] Government Quinologist, to the Secretary to Government, dated 3rd August 1871.BPP, 1875:44.

This strategic release of information would hide the disappointingly low levels of quinine that were present in the bark and likely to put off buyers.[445]

Entering the new decade on the Nilgiris, new areas of investigation were emerging, as many of the trees in the government plantations were now reaching a productive age. On the 19th May 1870, the Secretary of State for India instructed the Government of Madras that, "It will be a point for your decision whether this bark should be used in the manufactory at Ootacamund for the supply of hospitals in India, or be sent to the London market, or whether a portion should be sent home, and a portion worked up on the spot..."[446] Broughton and McIvor were asked to give their opinion on the questions raised (they disagreed on many of them), illustrating the respect and authority awarded to the Quinologist as well as the Superintendent on all aspects of the experiment.

6.4.2 Drug Manufacture

Broughton had already begun investigating the capabilities of the Nilgiri region for furnishing materials for the manufacture of cinchona febrifuge (lime, soda, pearlash, magnesia, animal charcoal, sulphuric acid, and alcohol),[447] all of which (with the exception of sulphuric acid) were found to be obtainable in the surrounding districts.[448] He had then prepared samples of various cinchona preparations for medical trial in Gudalur, the most malarious of the Indian Medical Department's stations, and although the trial was small, results were largely positive.[449] Encouraged, Broughton began lobbying the government on the need to establish a manufactory on the hills, to allow the manufacture of greater quantities of alkaloids than he was currently able to create in his laboratory,[450] also requesting more chemicals and apparatus to be sent from England.

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[445] The bark was sold amongst other lots from South America on the 22nd December without a reserve, selling for between 2s 1d and 2s 10d per lb, (the unmossed barks achieving the highest prices due to their more natural appearance[445]), totalling a gross sum of £358, 10s and 8d. Letter from the Secretary of State for India to the Government of Madras, dated 19th May 1870. BPP, 1870:246.

[446] *Ibid.*

[447] Government of Madras to the Secretary of State for India, dated 18th February 1868. BPP, 1870:141.

[448] Broughton to Secretary to Government, dated 4th April 1868. BPP, 1870:148.

[449] Inspector General, Indian Medical Department, to the Secretary to Government, Revenue Department, dated 7th May 1868. BPP, 1870:153.

[450] Broughton to Secretary to Government, dated 18th June 1868. BPP, 1870:173–174.

Entering the second decade of Cinchona Cultivation on the Nilgiris, Broughton's 'Amorphous Quinine' (named by Dr. Mackenzie as it consisted of the alkaloids, mixed as they naturally occur in the plant precipitated from solution in an uncrystallised but tolerably pure state) had been declared highly efficacious, Broughton receiving around 2,000lbs of fresh bark weekly from the plantations,[451] with production taking place in a small manufactory erected near the Government Gardens[452] (his original contract had been extended in February on the understanding that he was not to resign without giving six months notice).[453] He had supplied around 70lbs of the preparation to the medical stores by August, with favourable results, finding *Cinchona succirubra* most suited for his preparation.[454]

The question of where the Nilgiri bark should be manufactured into febrifuge of some sort was an important one as location could potentially influence the quality or reputation of the finished product. Several years earlier, Howard had suggested that a manufactory of quinine on the Nilgiris would not be profitable. "If I had a bark plantation in India, I should unquestionably order the bark sent home, even if I had skilful and experienced workmen to whom the task could be safely confided in India of attempting to reduce the cost of transport."[455] In 1870, knowing that government were keen to cut back on their current expenditure, McIvor had also imagined it would be more economical for government to sell their bark and purchase the alkaloids than to manufacture them.[456] However, Broughton (supported by the District Commissioner) recommended the continuation of alkaloid manufacture on the hills, signs of strain emerging in the relationship between the Superintendent and the Quinologist. Stubbornness appears to have been a trait of many professional botanists involved with cinchona (Goss, 2004).

Broughton won this battle and in February 1872, the government authorised McIvor's proposal to convert the now disused jail at Naduvattam into "a suitable

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[451] AAR, 1869-1870. BPP, 1875:4.
[452] Government Quinologist to the Acting Secretary to Government, Revenue Department, dated 31st August 1870. BPP, 1875:14.
[453] Government of Madras to the Secretary of State for India, dated 14th February 1871. BPP, 1875:25.
[454] Government Quinologist to the Acting Secretary to Government, Revenue Department, dated 31st August 1870. BPP, 1875:15.
[455] Report of an analysis of the third remittance of bark from India by Howard to the Under Secretary of State for India dated 15th June 1864. BPP, 1866:50.
[456] Secretary to Government, Revenue Department, dated 2nd September 1870. BPP, 1875:18.

place for the manufacture of 'amorphous quinine.'"[457] The only account of this laboratory-come-manufactory space comes from Cross, written shortly after Broughton had disappeared;

> I have been down at Dr. Broughton's Laboratory several times and it is an awful chaotic looking place. Government have of course shut it up since he left. Stills, retorts, bottles of chemical, and jugs containing various preparations are all congregated together in the greatest confusion. The 'bath' where I was told he had his bark in its primary process – though I have no chemical knowledge – must have been wrong at the very beginning.[458]

Manufacturing of Amorphous Quinine during 1873-74 was not as satisfactory as it had been in the former year, "The amorphous alkaloids, when sent into the medical stores, were found to cake and run into a sticky mass, so that it could not be utilised, except by solution into an acid,"[459] the cause being an apparent error in manufacture. As a result, during 1874, a Committee comprised of the Commissioner of the Nilgiris and the Sanitary Commissioner was deputed to inspect operations at Broughton's manufactory. In their subsequent report it became obvious that, "The manufacture should at once be abandoned…Similar attempts have failed in Java and America, and the Government may well leave the matter to private agency."[460] Broughton immediately resigned from his appointment and disappeared. In the absence of a Quinologist, bark would be sent to the Secretary of State at the India Office where samples could be selected for analysis by Howard or Dr Vrij.

The experiment in alkaloid manufacture was, for the time being, abandoned, despite substantial financial investment.[461] Parallel activities had been taking place on the Bengal plantations. There, Mr. Wood (onsite Quinologist) was working on the production of a cheap febrifuge from *Cinchona succirubra*, recommending that a factory be fitted up in Calcutta, and that the appliances in Sikkim be maintained in order to work up the inferior bark (Anon, 1875). By 1878, Wood's febrifuge had been proved effective and its popularity was growing as this extract from the *Darjeeling News* shows. "The Government Febrifuge has been much used by

[457] Order of the Madras Government, 7th February 1871. BPP, 1875:24.
[458] Cross to J.E. Howard, dated Ootacmund, 28th February 1881. RBGK. JEH/1/137.
[459] Committee appointed to report on the efficiency of the Chinchona factory at Neddivuttum to the Secretary to Government, Revenue Department, dated 28th November 1874. BPP, 1875:181.
[460] *Ibid.* p.184.
[461] BL. *SIO.* 11th November 1882. p.7, col. D to p.8, col. A.

planters in this district within the last year and the general consensus of opinion after trial is that given in the same doses as quinine it is quite as efficient in curing ordinary cases of fever amongst the coolies as Howard's quinine."[462] *Nature* also reported on Wood's success.[463] However, the Ootacamund based *SIO* took exception to the reports, arguing that Wood's attempts to manufacture cinchona alkaloids had resulted in "a worse failure than the Neilgherry operations under Mr. Broughton," and that Wood's "improved process" of extraction was, "nothing more than a method carefully tried by Broughton, and discarded by him..."[464]

It took several years before manufacturing on the Nilgiris was resumed, largely owing to the absence of a Superintendent. Once Hooper was employed as Quinologist in 1884, he immediately re-started febrifuge production and began fitting out a much improved and larger factory. Considerable delays were experienced in equipping the factory, with machinery and chemicals being obtained from England. In the first year of operations (1889) Russian influenza struck nearby and many of the trained staff fled in fear (see chapter 7). The following year the factory suffered more setbacks as two of the new vats and the second still, "were sent in such a bad condition that they had to be almost remade before they became serviceable."[465] A slight extension of the vats and steam pans was still considered desirable so as to reduce the rate of working, in turn reducing waste in the use of bark and chemicals, and limiting the strain placed on the machinery. In addition the supply of chemicals from England was subject to considerable delay.

Entering the 1890s it was determined that the best outlet for the sale of the government's manufactures would be quinine packets sold through District Collectors. During 1891-92, 53,833 lb of bark was harvested from the estates, and the factory consumed a total of 144,500 lb, eating into its store from previous years, and also purchasing bark from private estates. The products dispatched from the Nilgiris were now almost entirely sulphate of quinine and febrifuge rather than raw bark. The factory had been in continuous production except for a fortnight in

462 BL. *SIO.* 15th April 1878. Planter's Sheet p.1, col. A-B
463 Extract in BL. *SIO.* 15th May 1878. p.2, col.B.
464 BL. *SIO.* 26th June 1878. p.1, col. A.
465 AAR, 1890-1891:4. RBGK. MRMC.

March when all the buildings were closed for repairs and cleaning, and the quality and appearance of factory goods was much improved.

The sale of quinine in paper packets slowly increased in most districts, but to no considerable extent. "From one district the whole of the packets were returned with the remark that 'next to no use is made of this medicine in this district'; also in another report it is gravely stated that the quinine causes itch."[466] Up to the present time government quinine had only been sold direct to planters and other persons where it had, "been ascertained that it was the intention of the purchaser to administer the whole of it to the coolies on his estates, and none has been sold to the public direct,"[467] although sale to the general public under certain conditions had been sanctioned in November 1891.[468] Hooper's laboratory had been moved from the Government Gardens to his own house 'Kelso Villa'.

Keen to increase the uptake of paper packets further, on the 4th August the experimental measure of using Postal Department officers as an agency for their sale was sent for consideration by the Commissioner of Revenue Settlement, Land Records and Agriculture and the Government Botanist,[469] and subsequently approved. The desired effect was achieved, 334,500 packets distributed through 1893-94.[470] The Bengal plantation and factory were now being worked at a small profit each year, and it was supposed by His Excellency the Governor in Council, that the same results should be obtainable in Madras.[471] The increasingly large stocks of quinine and febrifuge (4,984 lbs of quinine and 1,946 lbs of febrifuge at 31st March 1895) were, Lawson explained,

> ...not to be deplored, first because there are signs that the sales during the coming year will be considerably in excess of those effected during the present year; secondly, because if any untoward circumstances should occur, such as a failure in the receipt of chemicals (when the factory would have to be closed), the present stock would enable Government to tide over the difficulty.[472]

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466 AAR, 1891-1892:5. RBGK. MRMC.
467 AAR, 1891-1892:6. RBGK. MRMC.
468 *Ibid.*
469 List of the Proceedings of the Madras Government embodying reports on Botanical and Agricultural matters for transmission to Kew, dated 4th August 1893. RBGK. MRMC. 1860-97.
470 AAR, 1893-94. RBGK. MRMC.
471 *Ibid.*
472 AAR, 1894-95:6. RBGK. MRMC.

The scheme to issue the quinine powders to Post Offices was now underway in 315 Post Offices in five districts selected by the Board of Revenue, following a decision that it would be safer for the quinine to be put up in closed envelopes. As Lawson reported,

> Up to the end of the year only 40,000 closed envelopes had been received from the Superintendent of the Government Press. The cost of filling it is more than double that of filling the wrapper. It is very doubtful, too, if the closed envelope is really any safeguard against dishonesty – a damp cloth would dissolve the gum by which the envelope could be easily opened; or a minute puncture made by a needle at one corner of the envelope (which would scarcely be visible to the naked eye) would be sufficient to enable a dishonest Postmaster to shake the whole of the quinine out.[473]

During a period of leave, Superintendent Lawson had visited Dr. King at Calcutta and Mr. Gammie at Mungpoo, and "from both of these gentlemen much information and many useful hints on many matters connected with the cultivation of cinchona and the manufacture of quinine were obtained."[474] New orders for Nilgiri manufactures were also emerging. Local Fund and Municipal hospitals had, from the commencement of the official year 1895-96, been instructed to obtain quinine and other medicines independently of the Madras Medical Stores Department, resulting in their direct application to the Cinchona Department for quinine sulphate and febrifuge, adding considerably to work at Head Office.

However, after the death of Superintendent Lawson in 1896, George King concluded that the recent work devolving on recent years on the Government Quinologist was not sufficient to justify the retention of a full-time chemist, and the position was abolished on the 23rd May 1897, the Director of the new Cinchona Department (as distinct from the Botanical Department) now being in immediate and sole charge of the manufacture of quinine.[475] This was in spite of the factory, under Hooper's supervision, obtaining the best results since production had begun, after the introduction of a second 'washing' (treating the bark twice with the mixed oils), in order to more completely exhaust the bark of its alkaloids, and the introduction of monthly returns for production.[476] 7,891 lbs of quinine and 1,100 lbs

[473] *Ibid.*
[474] *Ibid.*
[475] AAR, 1896-97. RBGK. MRMC.
[476] *Ibid.*

of febrifuge had been produced, from 238,100 lbs of bark. Issues of quinine had amounted to 5,908½ lb, an increase of 264½ lb on the previous year, chiefly due to the larger sales effected by Postmasters which were proving to be a more successful agency for the sale of quinine to the poorest classes than the District Collectors.[477]

Supplies from England (particularly of fusel oil, a by-product in the distillation of spirits) continued to be problematic for the duration of the factory's life. Manufacture was suspended for several months after the unfortunate loss at sea on the 8th April 1898, of fifteen tons of fusel oil and four tons of sulphuric acid.[478]

Over the course of the year 1899-1900, a record amount of quinine was issued, 7,378¼ lb, owing to an increase in the number of hospitals and dispensaries supplied direct, 650 against 396 in the previous year. Still, there remained a balance of 14,400 lbs of quinine and 13,213 lbs of febrifuge in store, with a normal demand this was equivalent to about two years' supply of quinine and five years' supply of febrifuge, and in these circumstances the opportunity was considered favourable for taking the preliminary steps towards a radical change in the working of the factory.[479]

6.5 Print Space

In this final space of cinchona science, the geographical focus is broadened to allow an engagement with the wider cinchona network. As Philip explains the sheer scale of the cinchona enterprise, "involving botanical activities in disparate locations on three continents, makes it a classic illustration of the role of botanical networks in the nineteenth century world economy" (1999:121). Although plants, seeds and people were also exchanged over this network, it was largely through the exchange of printed material that knowledge on the cinchona was debated and advanced. As Shapin explains, "Intercalculating science or technology into larger and larger networks of action is what makes them durable. When all the elements in a network act together to protect an item of knowledge, then that knowledge is strong and we come to call it scientific" (1995:308). As already briefly considered in relation to

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[477] *Ibid.*
[478] AAR, 1897-98. RBGK. MRMC.
[479] AAR, 1899-1900. RBGK. MRMC.

reports in scientific periodicals, proponents of cinchona science on the Nilgiris had to publish in order for their authority and expertise to be recognized elsewhere.

Livingstone explains the ways in which "...spatial thinking may illuminate the place of written documents, conversational interchange and expert authority in scientific culture... The material sites of book production, the circulation networks through which mass print criss-crosses the globe, and the social spaces of book acquisition, for example, are all inherently spatial phenomena" (2005:94). Dritsas's examination of the geography of the Zambesi expedition successfully demonstrates "the role of travel in the making of mid-nineteenth century natural history and in developing the relationships and credibility necessary to perform the research on which classifications undertaken elsewhere were based" (2005:35). Just as in the Zambesi expedition, in the cinchona experiment, "the sites of collection, facilitation and analysis are particular locales that fit into a larger, distributed pattern of knowledge generation necessary for the whole project to succeed" (Dritsas, 2005:52).

6.5.1 Cinchona Planting Manuals

As has been explored above, the cultivation of cinchona by government aimed to convince private cultivators of the tree's merits. But this was an entirely new operation and differed from raising coffee or tea. A number of individuals involved in the government experiment, therefore, published manuals offering guidance to the private planter on all matters cinchona (table 6.2). Both McIvor and King's manuals were official government publications suggesting that they were both required to write them. Bidie's book was published by the Madras house Higginbotham & Co, Owen and White's by the Ceylon Press (see below), and Markham's travelogues by John Murray,[480] famed for their publication of travel guides. As Goss explains, government botanists, previously used to working alone, were now expected to possess multiple skills, which proved something of a challenge for many. "They had their own ideas about how tropical nature should be managed, and had little patience for writing reports" (Goss, 2004:89).

[480] See: http://www.geos.ed.ac.uk/research/humangeography/Correspondence.html [accessed 16/01/10] for more on a project at the University of Edinburgh using the John Murray archive.

Table 6.2 – Dates of Publication of Key Cinchona Planting Manuals

Date	Title
1862	*Travels in Peru and India whilst superintending the collection of chinchona plants and seeds in South America, and their introduction into India* by Clements Markham
1863	*Notes on the Propagation and Cultivation of the Medicinal Cinchonas or Peruvian Bark Trees* by William McIvor
1867	*Notes on the Propagation and Cultivation of the Medicinal Cinchonas or Peruvian Bark Trees* by William McIvor, 2nd edition
1876	*A Manual of Cinchona Cultivation in India* by George King
1877	*Handbook to Cinchona Planting for Ceylon Planters* by Harold White
1879	*Cinchona Culture in British India* by George Bidie
1880	*Peruvian Bark: A Popular Account of the Introduction of Chinchona Cultivation into British India, 1860-1880* by Clements Markham
1880	*A Manual of Cinchona Cultivation in India* by George King, 2nd edition
1881	*The Cinchona Planter's Manual* by T. C. Owen
1883	*A Handbook of Cinchona Culture* by K.W. van Gorkom translated into English by B.D. Jackson

On the 22nd June 1866 McIvor reported to government that to date, only one edition of his manual had been published, and, not having a single copy of this left, he urged government to approve a further edition,[481] which they did immediately. When an application for Indian grown seeds arrived from Mexico in April 1866 (a place "where Humboldt considered that success would be certain"),[482] McIvor's *Notes on the Cultivation,* was translated into Spanish, already having been translated into Portuguese at Goa.

The manual by George King of the Calcutta Botanic Gardens also ran to two editions (1876, 1880), illustrating his success and the demand for authoritative knowledge. Publication may also have been a personal goal for these botanists as Secord explains.

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481 McIvor to Acting Secretary to the Madras Government, dated 22nd June 1866. BPP, 1870:16.
482 Clements Markham to the Under Secretary of State for India, dated 16th April 1866. BPP, 1866:198.

> Botany could boast more paid professionals than other sciences in the early nineteenth century, but nonetheless most practitioners were private individuals whose community was defined through correspondence networks and by membership in societies. Many expert botanists attempted to enlarge this community by simultaneously producing consumers of botanical works and active participants in botanical science... popular books were seen to be those that best achieved the aim of making more people into botanists (Secord, 2002:55).

Meanings and authorities change from place to place (Naylor, 2005b), with the credibility attributed to the author being linked not only to their social status but also to their geography or place of writing. Livingstone thinks the significance of location in assembling authoritative credentials is worthy of further consideration because "...propositions are accepted as facts, at least in part, because of the spaces in which factual assertions are made" (2000b:294). Those individuals like McIvor and King who published successful manuals were trusted because of their associations with the government project which, at least at the time, was deemed a success. Other men were also awarded authority after being invited to inspect and report on the government plantations, their primary experience of seeing how it was done being recognized as valuable value by those who didn't have the same privileged access.

6.5.2 Progress Reports

The most comprehensive printed record of the Nilgiri plantations comes in the form of the AARs. McIvor was kept informed of the progress at Java through the forwarding of the reports of the respective Superintendent.[483] He was also charged with making sure information on the cinchona reached those who required it. When copies of the Dutch Superintendent's report were forwarded to India in August 1861, along with copies of Markham's pamphlet on the species growing in India, and Mr. Pritchett's report in the cinchona region of Huanaco in Peru, Sir Charles Wood specified, "You will also supply one or more copies of these pamphlets to the different agricultural and horticultural societies in India, in order that the useful information they contain may be as widely circulated as possible."[484]

[483] Sir C. Wood, Secretary of State for India to His Excellency the Honourable the Governor in Council, Fort St George, dated 2nd July 1861. BPP, 1863:177.
[484] Sir C. Wood to the Governor of Madras, dated 9th August 1861. BPP, 1863:186.

In 1862, reports made by Cross and Spruce were forwarded (50 of each) from the India Office for distribution to McIvor and others, "who are entrusted with or interested in the cultivation of the cinchona plants in India."[485] In May of the same year McIvor urged that copies of the yearly reports should be "...printed in a convenient pocket form, I respectfully beg to solicit the favour of being supplied with 50 or 100 copies for the use of the establishment, and for distribution to those anxious to try chinchona cultivation in this country."[486] Some saw that this greater distribution of knowledge as not a necessarily good thing. The Superintendent in Bengal, Anderson commented in February 1862 that the ignorance of the subject had,

> "...given rise to a series of pamphlets and letters containing a great deal of irrelevant matter. I have before me six pamphlets, containing 286 pages of printed manner, besides 142 pages of printed correspondence, on this subject, which, with the exception of one or two short letters, have all been published during the last nine months."[487]

McIvor's reports were also regularly sent to the Superintendent of the cinchona plantations in Java and elsewhere.

Fairly regular updates on the experiment can also be found in the scientific journals – particularly *The Pharmaceutical Journal*, where the results of the latest analyses were often relayed to its readership. Apart from reporting analyses, the science journals also reported on the presence of cinchona in international exhibitions. After plants were sent to the Museum of Natural History in Paris in 1862, display in museums and exhibitions became a key mode of relaying the progress of the cinchona enterprise to the world. For those unable to visit, these reports described the highlights. At the Paris Universal Exhibition of April 1867 the Howard and Sons fine collection of 'Chinchona barks and salts' was a popular exhibit.

> "No less than 160 specimens of true and false Chinchona barks are shown by this firm. Amongst them are a series of specimens from our East Indian Chinchona plantations, which are already yielding bark of a quality far surpassing all expectations. There are also examples of the salts extracted from them, being the first ever exhibited" (Anon, 1867c:76-77).

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[485] Bourdillon to Pycroft, Chief Secretary to Government, Fort St George, dated 17th January 1862. BPP, 1863:173.
[486] McIvor to Sim, dated 31st May 1862. BPP, 1863:228.
[487] Anderson to Grey dated 11th February 1862. BPP, 1863:201.

The less scientifically minded reader could also pick up cinchona knowledge from the newspapers. Markham placed a short notice in *The Times* on the 5th June 1863 to inform readers of the progress in India,

> As great numbers of persons are watching with deep interest the progress of the experimental cultivation of quinine-yielding chinchona trees in India, I should feel obliged if you would make public the important and gratifying fact that quinine and other febrifuge alkaloids have already been extracted from bark grown in India. Specimens of bark of only two years' growth have been forwarded from the Neilgherry hills, and analyzed by Mr. Howard with most satisfactory results... the percentage product of alkaloids is as great as would be met with in South America (Markham, 1863:5).

The Nilgiri plantations were also twice celebrated in *The Illustrated London News* (figures 6.9 and 6.11). On the Nilgiris, individual planters used the *SIO* as a public platform to air their problems and search for scientific advice, and the newspaper also published longer articles on cinchona planting, as well as reproducing manuals relating to planting matters. The contribution of the press to scientific planting was even greater in Ceylon, and the impact of this certainly spread to and was influential in the Nilgiris. As Barron explains,

> Largely due to the passionate identification which the press barons of the island, the Fergusons, had with the planters, there emerged from Ceylon in the second half of the nineteenth century a long series of publications dealing with all sorts of crops and cultivation matters... Ultimately two major sources of information emerged from this, which were to enjoy great celebrity, scholarly respectability and longevity: Ferguson's *Directories* and the journal *The Tropical Agriculturalist* (Barron, 1987:18).

6.5.3 Personal Correspondence

The cinchona experiment brought together individuals who in most cases had not previously known each other. Cinchona became their common interest, and friendships and rivalries developed. The best example of the importance of these personal networks, and of individual actor's motives and intentions, are the letters exchanged between John Eliot Howard and Robert Cross.[488] As Endersby explains, "Uncovering and analyzing colonial actor's stories can help us see how their ambitions, their stubbornness, and their loneliness were as important as their

[488] RBGK. JEH/1/16 and JEH/1/37.

taxonomic and collecting practices in shaping the history of nineteenth-century botany" (2001a:356). Howard and Cross exchanged thoughts, knowledge and specimens over a period of seventeen years. For example, on the 19th April 1867 Cross wrote, "I hope to be soon in London to see your specimens of the Uritusinga. I enclose two leaves of a Loxa C. + would be glad to know its name. When you write, send me a leaf or even half a leaf of the Uritusinga – the smallest morsel will suffice…"[489] Cross proposed to make his third visit to the Pitayo forest that summer where he intended to collect specimens of the local cinchonas, promising to send Howard a set of the best. Howard subsequently sent the leaf of the *Cinchona uritusinga*[490], and also informed Cross that McIvor was hoping to visit England soon. Howard often appealed to the India Office on Cross' behalf, as on more than one occasion Cross felt hard done by.

Human relationships remain a necessity in the generation of new knowledge about the natural world (Livingstone, 2005), connections in place between trust, expertise and the circulation of credibility. In referring to Dritsas' work on the Zambesi expedition, Livingstone explains that, what becomes clear is, "that there was a crucial connection between travel experience and testimonial authority, between geographical location and sound reputation" (2005:97).

6.6 Conclusion

This chapter has explored "the ways in which knowledge operates across different scales and manifests itself in particular situations", using the specific example of cinchona to add to broader debates, "about the making, circulation and consumption of knowledge" (Naylor, 2005a:632). On the Nilgiris, important contributions to cinchona science were made in the botanical garden, plantation, and laboratory and in print. Through careful experimentation, and by explaining the scientific nature of these practices in journals and manuals, members of the Nilgiri cinchona project established names for themselves and for Nilgiri bark.

As Livingstone recognizes, "Precisely what the correct scale of analysis is at which to conduct any particular enquiry into the historical geography of science – site,

489 Robert Cross to John Howard dated April 19th 1867. RBGK. JEH/1/16.
490 Robert Cross to John Howard dated April 26th 1867. RBGK. JEH/1/16.

region, nation, globe – has to be faced. Such decisions, moreover, are complicated by the realization that the local and global intertwine in ways that make them mutually transformative" (2005:100). Although attention has here been focused on the local and regional scales, the global nature of the cinchona network, over which seeds, plants, people and print were exchanged, has become visible. By situating the cinchona on the Nilgiris, the experiment was able to utilize the communication networks that already radiated from them (see Pradhan, 2007). McIvor and others carved the Nilgiris into a 'truth spot', a place where certain actors were brought together, and a place from which others are kept out, where certain practices are favoured and facilitated and others are constrained or rejected (Naylor, 2005b:6). "Once knowledge can be analysed in terms of region, domain, implantation, displacement, transposition, one is able to capture the processes by which knowledge functions as a form of power and disseminates the effects of power" (Foucault, 1980:69 in Ophir and Shapin, 1991:12).

In many respects there was a belief that the knowledge being produced on the cinchona was not just valid in the Nilgiris, and indeed was universal, and should be applied elsewhere. However some aspects of cinchona science were found to be unique to the Nilgiri region in their suitability. Cinchona science provided a boost in the opportunities of acclimatization science more generally, and the spaces of science were "far from merely incidental to the enterprise" (Livingstone, 2000b:286).

7 Managing Cinchona

The cultivation of cinchona required careful management. This chapter deals in turn with three elements of managing the cinchona plantation system on the Nilgiris: i) labour, ii) activities through 'the cinchona year', and iii) environmental constraints on cinchona production.

7.1 Labour

A reliable and appropriately skilled labour force was an essential requirement in the smooth running of the cinchona plantations. Large numbers of workers were employed, particularly during the period of establishment and during the bark harvest, and there were numerous tasks to be completed throughout the cinchona year (section 7.2). In his analysis of government cinchona plantation workers in Darjeeling, Sharma explained the selection of cinchona plantation sites through their proximity to large labour pools (and favourable climates). "Cinchona plantations were mainly introduced and expanded in India and Indonesia successfully due to their suitable climate and availability of cheap labour force" (Sharma, 1997:1). This statement obscures the multiple difficulties associated with obtaining and retaining labour on the Nilgiri cinchona plantations. The aim here is to first establish the labour hierarchy, moving on to then examine each level of the hierarchy in more detail to discover how the labour force was procured, managed and disciplined, incorporating an analysis of the reasons for and effects of, periods of both labour shortage and oversupply. Etemad's supposition that the history of cinchona cultivation is, "...a tale of martyrdom – the martyrdom of tens of millions of men and women who were exploited and humiliated on the Asian plantations" (2007:29), is also examined.

7.1.1 Labour Hierarchy

The Superintendent of cinchona plantations in the Madras Presidency was based at the Government Gardens at Ootacamund, from where he also acted as Superintendent of the Botanical Department until the two departments were separated in 1896. Only three Superintendents were officially appointed over the study period of 1860-1900: William Graham McIvor, Professor Marmaduke

Lawson and W. Standen, although seven other men held the post in an 'officiating' capacity in the absence of an appointed Superintendent (table 7.1).[491] The aim here is to discover who these men were, how they were recruited and managed by government and, in turn to investigate their own strategies for managing the plantation labour.

Although answerable to, and given orders by government, the Superintendent was in immediate charge of the government cinchona enterprise, and dictated what happened on the ground. In 1861 Markham estimated that,

> The staff eventually required for the conduct of the cinchona experiment would thus consist of - Mr. McIvor, to superintend the whole, especially the plantation near the gardens; two European gardeners, one at Neddiwuttum, and the other at Coorg; a native with some education on the Pulneys, and the necessary number of native overseers and labourers.[492]

The system was implemented largely as Markham had envisioned. European overseers (usually a 'head' and 'deputy') were eventually appointed at each of the government plantation sites of Dodabetta, Naduvattam, Pykara and Mailkoondah, and charged with supervising the propagating, planting, harvesting, and overall management of their designated site. Below the overseers were several other salaried members of staff, including office staff, factory managers, and gardeners dedicated to the experiment employed within the Government Gardens.[493] As the century progressed a small number of Indians were increasingly employed in a number of these supervisory positions, but on the whole these were jobs filled by Europeans. The plantations were then largely dependent on indentured labour to complete the majority of the tasks, a small proportion of which held more supervisory roles. This labour force arrived in a variety of forms, including indigenous hill tribes, convicts, and migrants from neighbouring districts (see section 7.1.4). This employment hierarchy followed the Dutch mode already in operation in Java, details of which were requested by the India Office early in 1862.

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[491] For details of the parallel Dutch system in operation on Java, see Goss, 2004:96-115.
[492] Markham to the Under Secretary of State for India, dated Bombay, 26th February 1861. BPP, 1863:146.
[493] The 'Estimate of Cost of Cinchona Plantations on the Neilgherries', included, for the nursery at Ootacamund a European gardener, a head propagator at 35 rupees, two first assistants at 10 rupees each, three second assistants at 7 rupees each, six gardeners at 6 rupees, six gardeners at 5½ rupees and one peon at 7 rupees. McIvor to J. W. Breeks, Private Secretary to His Excellency the Governor of Madras, dated Ootacamund, 16th August 1861. BPP, 1863:179-180.

> The experimental cinchona culture, at the place where it is introduced, will be under the supervision of European overseers [usually old soldiers[494]], who will be appointed to that office on the recommendation of the superintendent... The European overseers are directly subordinate in the discharge of their duties to the superintendent...Under their orders are placed the native overseers and labourers who are employed in the cinchona culture. The experimental cinchona culture is to be carried on, if anyway possible, entirely by means of free labour....[495]

The Dutch mode emphasized the importance both of maintaining good relations between all levels of the hierarchy, and of all labour residing within the plantation boundary, advice to which the Nilgiri plantations would adhere.[496] Private plantations on the Nilgiris operated with a similar structure. Proprietors (often absent for lengthy periods) frequently employed European managers to oversee the indentured labour that was usually procured using the *maistry* system (see below). Where estates were owned by registered companies, shareholders usually nominated a team of directors who employed a European manager to oversee the management of the estate.

Differing from the pattern in neighbouring districts (like Coorg), where Indians played an important role in the early development of plantation agriculture,

> In Nilgiris on the other hand the entrepreneurs[497] were almost exclusively Europeans... the indigenous population consisting of tribes like the Badagas, Irulas, Kurumbas, and Paniyans were – unlike the Coorgs – not in a position to provide the financial, organizational, and technical foundation essential for the establishment of plantations (Folke, 1966:210).

Instead these tribes found themselves recruited to work on the plantations (see section 7.1.4). Most estates then had agents in Madras (and sometimes also in Calicut or Cochin), a number of which (Arbuthnot and Co, Binny and Co, Gordon, Woodroffe and Co and Parry and Co) went on to become some of Madras's best known companies.

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494 Dr. Macpherson to the Secretary to the Principal Inspector General, Medical Department, dated Madras, 10th December 1860. BPP, 1863:137.

495 'Annex to Report on Cinchona Plantations in Java' by A. Fraser called for by the India Office and dated 21st January 1862. BPP, 1863:267.

496 *Ibid.* p.268.

497 Although Indian planters rose in prominence on the Nilgiris as the century progressed (chapter 4).

7.1.2 Superintendency

In his position as Superintendent of the Government Gardens at Ootacamund, McIvor was perfectly placed to take on the additional responsibility of the cinchona plantations in the district when the first plants arrived in 1860. He had completed training at both the Royal Botanic Gardens at Edinburgh and Kew, and now also had twelve years experience of living, planting, and managing labour on the Nilgiris. McIvor was by and large a popular Superintendent and popular community figure, credited with successfully acclimatizing the cinchona to India.[498] He was totally devoted to the cinchona cause, urging upon potential cultivators the advantages which cinchona could provide, and forming friendships and business deals with several private planters.[499] We know employees from other government cinchona sites were sent to McIvor for training (King, 1876:30).

McIvor saw himself as a largely irreplaceable element in the cinchona experiment, and it was perhaps this lack of modesty that led to his fractious relationship with government and other prominent figures employed in the project. Over the course of his superintendency there were a number of brutal attacks on his reputation and methods (not least from the rival Darjeeling team), and misunderstandings with government twice resulted in him threatening his resignation. He had reached breaking point in 1875, when he wrote to the District Commissioner Mr. Cockerill, "I feel the time is approaching when my career as a servant of Govt must terminate, if therefore the true condition of this undertaking is not understood, the labour of years may be rendered unproductive."[500] "Interference" had in McIvor's opinion "shaken the confidence of Govt in my ability,"[501] and he'd been placed subordinate to the District Commissioner on the 6th April 1869, officially in consequence of him holding private cinchona property in the district. Upon assuming control the Commissioner implemented his own estimates of working expenses and dismissed the whole trained establishment, against protest from McIvor. This act was severely detrimental in a region where labour was scarce, and at a time when the first harvest of bark under the mossing process (a process requiring skill and care)

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498 See Anon, 1876a and 1876b for obituaries of McIvor.
499 McIvor invested in the Ossington cinchona estate, his substantial share passing to his wife Anne upon his death, see NA. DD/1440/39/1.
500 McIvor to Cockerill, dated 2nd August 1875. RBGK. JEH/2/3.
501 Ibid.

was to be taken. As McIvor explained to Cockerill, "At intervals during the existence of this undertaking, we have seen advanced under the cover of science, a display of pitiful ignorance existing in the minds of men on a subject in which they would direct."[502]

Table 7.1 - Superintendents of the Government Cinchona Plantations, Madras

Superintendent	Year(s) of Office
William Graham McIvor	1860-1876 (subordinate to District Commissioner from 1869)
Mr Jamieson	(officiating 1876 upon McIvor's death)
- Control of the Cinchona plantations passed to the District Commissioner between 1876 and 1881.	
Mr A.M. Webster	1876-1878
Mr Barlow	1878-1880
Mr Roupell	1880-1881
- Control of the Cinchona plantations passed to the Forest Department and the superintendence to the Deputy Conservator of Forests between 1881 and 1883.	
Colonel Jago	1881-1882
H.S. Gass	1882-1883
- Control now returned to a specialist Superintendent	
Professor Marmaduke Lawson	1883-1896
David Hooper	(officiating 1896 upon Lawson's death)
W.M. Standen	1896-1901
George Rouilly	(officiating 1901-1902 whilst Standen was on leave)
W.M. Standen	1903-1908
Henry Valentine Ryan	(officiating 1908-1909 whilst Standen was on leave)
W.M. Standen	1909-1912
Henry Valentine Ryan	1912-1915
E. Collins	1915-1916
A. Wilson	1916-1930
- Shortly after 1930 the cinchona department was to be absorbed in a central department for agriculture	

Upon his death in 1876, there was no obvious replacement for McIvor and the plantations were left without a dedicated Superintendent for almost six years. With no authoritative figure onsite, the plantations fell into a state of decay. It was not until 7th January 1882 that Joseph Hooker received confirmation that the Madras

502 *Ibid.*

Government had at last decided that they needed an experienced man to look after their cinchona plantations.[503] A letter from Major Campbell Walker of the 15th March 1882 provided further details,

> ...The man must be thoroughly good, sober, honest and with his heart in the work and you must bind him down in the strictest way to devote his whole time to government service and not acquire any private interests directly or indirectly or undertake the supervision or management of any private estates. This is the rock upon which all this class of men split out here which ruined McIvor and is ruining Jamieson and Rowson as public servants for they do not seem to be able to do good honest work for government when they have private concerns and get above their work.[504]

Several people had already been recommended or put themselves forward for the position. Mr. Pearson had written from the Forest School at Nancy, France, in March 1880 suggesting that one of his pupils may be suitable.

> I have two especially good viz., Murray and Porter. The former is a son of a former Colonel of the old 42nd Highlanders (Black Watch) and is an exceptionally good lad, with enormous powers of work, very intelligent, very steady, and exceptionally strong in the natural sciences – he has a terrible stammer, which prevented any possibility of going into the Army...if you thought of training a specialist for Chinchona, I would strongly recommend him for it...[505]

Mr. Ferguson (of Ceylon planting fame) applied for the post in March 1882 but in Grant Duff's opinion, "he spoils his case by the absurd way in which he puts it."[506] E.M. Holmes of Finsbury Park was the first to be officially approached for the post, but declined the offer.[507] Current Professor of Botany at Oxford, Marmaduke Lawson was the second choice, and answered:

> The conditions on which the appointment to the Nilgiri Cinchona Plantation is to be held seems to be so much to my taste & so liberal that I shall certainly think very seriously before refusing your offer of it...The fact is I am sick of Oxford & shall be glad to get away from it – For fourteen years I have fagged [?] hard to set up a School of Botany in the place, & have been wholly unsuccessful in my attempt...[508]

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[503] H. Danvers to J. Hooker, dated 7th January 1882. RBGK. MRMC, 1860-97.
[504] Extract letter from Major Campbell Walker, dated 15th March 1882. RBGK. MRMC, 1860-97.
[505] G.F. Pearson to J. Hooker, dated 30th March 1880. RBGK. MRMC, 1860-97.
[506] E. Grant Duff to Danvers, dated Guindy Park, 27th March1882. RBGK. MRMC, 1860-97.
[507] E.M. Holmes to W. J. Thiselton Dyer, dated Finsbury Park, 9th May 1882. RBGK. MRMC, 1860-97.
[508] M.A. Lawson to W. J. Thiselton Dyer, dated Botanic Garden Oxford, 13th May 1882. RBGK. MRMC, 1860-97.

Lawson's botanical experience and personal connections to colonial botanic gardens lent Hooker to decide that his appointment,

> "...would be likely to meet the requirements of the Madras Government in the best possible way. Professor Lawson is unmarried and about 40 years of age. He is of remarkable robust constitution and energetic habits. He is of course well versed in the scientific details of structure and physiological botany and having been for some years Professor of Botany at Oxford (where he is extremely popular) is acquainted with the horticultural details and administration of a garden...he has been undoubtedly influenced by the example of his personal friends Mr. Duthir, Superintendent of the Government Gardens, Saharanpur & Dr Trimen, Director of the Royal Botanical Garden Ceylon."[509]

On the 19th October 1882, Lawson was notified of his new appointment, at a salary of Rs 600 with an official residence and free passage to India as soon as he was prepared to start.[510] He was then to be, "...allowed to proceed in the first instance to Ceylon and to spend three or four weeks with Dr Trimen in the study of everything connected with cinchona cultivation there."[511] He also met with Markham in November, who recommended that he take lessons in 'Assaying bark'[512] from a man called Wood.[513]

Lawson quickly settled into his new role, investigating the main issues now presenting themselves to the region's cinchona planters. He advocated the creation of new quinine manufactories, convinced that they would improve the bark market (see below).[514] Lawson remained as Superintendent until his death in February 1896.[515] The Cinchona and Botanical Departments were then separated on the advice of George King of the Calcutta Botanic Gardens, and Mr. W.M. Standen was appointed Director of the newly constituted Cinchona Department in May.

In contrast to the Superintendent, the private planter's life could be very isolating. Cinchona planters though had a closer relationship to government officials than growers of other plantation crops, as government led the way and actively

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509 W. J. Thiselton Dyer to L. Mallet, dated RBGK, 2nd August 1882. RBGK. MRMC, 1860-97.
510 L. Mallet to W. J. Thiselton Dyer, dated India Office, 19th October 1882. RBGK. MRMC, 1860-97.
511 W. J. Thiselton Dyer to L. Mallet, dated RBGK, October 20th 1882. RBGK. MRMC, 1860-97.
512 Meaning to chemically analyse.
513 M. A. Lawson to W. J. Thiselton Dyer, dated Botanic Garden Oxford, 24th November 1882. RBGK. MRMC, 1860-97.
514 M. A. Lawson to W. J. Thiselton Dyer, dated Government Gardens Ootacamund, 10th November 1884. RBGK. MRMC, 1860-97.
515 AAR, 1895-96. RBGK. MRMC..

encouraged their cultivation. Membership of the Ootacamund club further integrated them into the hill social scene. Very little is known about the indentured labour they employed, or their methods of managing it, but this most probably operated with a similar but scaled down labour structure to the government plantations, as illustrated by the frontispiece to Robert Henry Elliot planting memoir (Figure 7.1).

Figure 7.1– Robert Henry Elliot's Bungalow, with the Coolies, Overseers and European Manager Assembled Before Setting Out for their Day's Work on the Plantation

BARTCHINHULLA BUNGALOW.—THE MORNING MUSTER

Source: Elliot, 1871:frontispiece.

7.1.3 <u>Subordinate Staff</u>

The head overseers of the government plantations usually came recommended from Kew directly after a period of employment under Sir Joseph Hooker,[516] or became involved after escorting cinchonas to India or collecting them in South America (Robert Cross was twice offered and twice declined the superintendency/head

[516] A list of past 'Kewites' in the *Journal of the Kew Guild* from 1893 includes several men who went on to be involved in the cinchona experiment including; Adolf Biermann who escorted plants to the Nilgiris in 1879, George Batcock McIvor's original Assistant Superintendent from 1861, James Gammie who went to manage the government cinchona plantations in Bengal in 1865, William Harris asked to superintend those at Jamaica in 1881, Amos Hartless assistant superintendent in Bengal from 1889, Andrew Jamieson asked to curate the Government Gardens at Ootacamund in 1868, Robert Pantling first assistant in Bengal from 1877, and Joseph Parkes an assistant in Bengal from 1879. See Anon, 1893:53–60.

overseer position at Naduvattam, in 1861[517] and 1881).[518] Sharma's study of the Darjeeling plantations supports this analysis. "It was quite interestingly noted that till 1950, all the top ranking managerial personnel were British from England" (1997:23). Former private planters like Henry Valentine Ryan were also recruited as overseers. A man "whose zeal and assiduity in every branch of his work cannot be sufficiently praised,"[519] Ryan eventually became Superintendent of the Nilgiri plantations in 1912.

Very little else is known about these men and their management of the estates, their names only mentioned after notable successes or failures. The turnover in the lower ranking positions of authority appears quite high, although a small number of the Deputy Superintendents appear to have devoted the best part of their lives to cinchona, only retiring when ill health demanded it of them. Mr. G. Batcock (selected by Sir William Hooker)[520] was the first European overseer, engaged for five years as McIvor's deputy in both the gardens and plantations.[521] In the end he stayed for seven, retiring owing to ill-health.[522] Mr. Patmore was the first head overseer on the Naduvattam plantation, and Lyall the first man placed in charge of the Dodabetta plantation.[523] Lyall had arrived on the hills with a single plant of *Cinchona uritusinga*,[524] but was quickly dismissed on the grounds of negligence and insubordination.[525]

In the opening full year of operations, McIvor "severely felt the want of a good accountant and office manager" the poor salary being apparently insufficient to secure an appropriately trained man, a Mr. Hollis having left the position without notice when offered a higher salary by coffee planters.[526] This competition with

[517] Letter from Government of Madras to Sir Charles Wood, dated Madras 24th April 1861. BPP, 1863: 164. Government's second choice was Robert Weir (Markham's expedition assistant gardener) but he'd already sailed for Brazil for the Horticultural Society, see letter from Markham to Under Secretary of State for India dated Torquay, 30th May 1861.BPP, 1863: 168.
[518] This position was offered to Cross whilst Rowson was on leave from the position. Letter from Col. Jago to Cross, dated Neddiwattum, 15th November 1881. Will Cross Private Collection. Photocopy of original held at RBGK.
[519] AAR, 1894-95. RBGK. MRMC.
[520] McIvor to Sir W. Hooker dated Ootacamund, 25th April 1863. RBGK. DC. Vol 57.f.109.
[521] Order of the Madras Government, dated 7th September 1861. BPP. 1863:183.
[522] AAR, 1867-68. BPP, 1870: 179.
[523] AAR, 1861-62. BPP, 1863: 241-242.
[524] H. Merrivale to J.E. Howard, dated India Office, June 16th 1862. RBGK. JEH/1/11.
[525] Secretary of State for India to His Excellency the Honourable the Governor in Council, Fort St George, dated India Office, 2nd January 1863. BPP, 1863:255.
[526] AAR, 1861-62.BPP, 1863: 242.

other plantations becomes more starkly apparent with indentured labour (see below).

Overseers were provided with accommodation onsite, for ease of observation and management of the experiment of which they were now a part,[527] and would be visited regularly by the Superintendent. In February of 1867, McIvor fell out of favour with the government for failing to ensure that the accounts of his subordinates were kept in an efficient manner.

> In August 1865, on visiting the Neddivuttum plantations, I found that Lieutenant Nichol, my subordinate in charge, appointed by me on the express terms that neglect or inattention would be visited by dismissal, had by carelessness in transplanting lost upwards of 12,000 Chinchona plants out of 16,000 he had planted out that month. I found on inquiry he had been drinking for some time, so as to incapacitate him for his duties.[528]

Nichol had been ordered to leave his post, but refused to give over charge, reacting angrily when an accountant arrived to audit his accounts;

> Lieutenant Nichol received him in a most boisterous and threatening manner, slamming the door in his face, and ordering him "off", and would not permit the accountant to have access to the books, or give and information; Lieutenant Nichol having now it appears removed the books and all papers from the plantations, and deposited them somewhere in Ootacamund.[529]

McIvor was in turn unhappy about the way he'd been criticised by the government over his handling of the incident, the effects apparently serving to undermine his own authority.

> Soon after Mr. Smith, an East Indian, whom I had engaged as an overseer, when in a state of destitution, and subsequently appointed in charge of the Dodabetta plantation, replied to my fault-finding by directly threatening me with Mr. Arbuthnot, upon which I summarily dismissed him.[530]

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527 AAR, 1861-62. BPP, 1863: 250.
528 McIvor to Secretary to Government, Revenue Department, Fort Saint George, dated Ootacmund, 29th September 1866. BPP, 1870:103.
529 McIvor to Secretary to Government, Revenue Department, Fort Saint George, dated Ootcamund, 6th March 1866. BPP, 1870: 98.
530 McIvor to Secretary to Government, Revenue Department, Fort Saint George, dated Ootacmund, 29th September 1866. BPP, 1870:102-4

Lawson also had to deal with troublesome subordinates, bringing a criminal case against Mr. Hillier, overseer at Naduvattam in 1885.[531] Venketruthnum Naidoo, manager of the Office of the Director of Government Gardens and Parks was also suspended from his post,[532] both men charged in connection with "certain irregularities during their employ in the cinchona department." In the Annual report for 1884-1885, Lawson recounted the incident,

> Mr. Hillier was convicted and sentenced to two years' imprisonment. Upon investigation little doubt could be entertained but that several of his subordinates had been in collusion with him, especially Pudmanaba Naidu the Sub-Overseer, and whom I have in consequence dismissed from the Government service...The Manager of this office [Venketruthnum Naidoo of the Head Office] was prosecuted at Coimbatore last February for having participated in the Hillier frauds and was convicted by the judge who tried the case. He was, however, set free on an appeal to the High Court at Madras. Nevertheless I dismissed him from Government service...[533]

It transpired that Hillier had received Rs 1,605-5-10 from the department deceptively and, "had also misappropriated about eight pieces of corrugated iron, besides timber, window frames, &c., from the materials of the dismantled jail..."[534]

7.1.4 Indentured Labour

The possibilities for labour procurement were a consideration in the selection of plantation sites for government, and no doubt for private planters too. However, basic geography often took precedence, meaning that labour had to be imported from elsewhere. The establishment of cinchona plantations on the Nilgiris coincided with the wider recognition of the value of the Nilgiri region as a planting centre, developments which served to dramatically increase the competition for a limited labour pool. Muthiah explains "when the jungle was opened up and coffee boomed, finding labour where no labour existed was a major problem as the labour of the plains was reluctant to work in conditions not far removed from those the White Man also lived in" (1993:9). Labour shortages on the government cinchona plantations first became apparent in the annual report for 1863-64.

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[531] BL. *SIO.* 10th January 1885. p.11, col D.
[532] BL. *SIO.* 24th January 1885. p. 11, col C.
[533] AAR, 1884-85. RBGK.MRMC.
[534] AAR, 1884-85. RBGK.MRMC.

> The difficulties previously experienced in procuring efficient men has been severely felt this year, in consequence of the number of coffee and tea plantations lately opened in the neighbourhood (no less than 36 having been commenced within the last 18 months); many of our best men have left either to open plantations for themselves, or to fill situations where greater inducements are offered.[535]

Methods of propagating and cultivating were amended to cope with the shortages, which had unfortunately coincided with a rapid increase in the amount of attention required by the increasing number of plants. When hardened off, the plants were now to be placed into a new and cheaper form of pot constructed from cow dung, which could then be placed directly in the beds, the spaces in-between them filled with earth. As McIvor recorded, "In this way the plants can be removed and transplanted by *untrained* labourers without danger of damage to their roots."[536] Baskets previously used to provide the required shade to the plants once planted out were to be replaced by split pieces of wood. "This rough split wood… requires *less* labour, as one man in this manner is able to shade from 50 to 60 plants per day."[537]

On many occasions McIvor felt restricted by having to wait for government approval before action. Being onsite he could see what the problems were, but seems to have frequently had trouble in communicating the details to government. After being ordered to stop clearing the Pykara site in 1864, the grain supply to the plantation was disrupted, and McIvor relayed that since explaining the orders of Government (as he had interpreted them) to his establishment,

> I have lost one maistry with 43 of my best trained men; and I much fear that if immediate steps are not taken to remove these restrictions, at least so far as they affect my establishment, we will shortly not have a man upon the plantation; and, as the dry weather is now setting in, this would prove its total destruction.[538]

Some months earlier, when not only was labour scarce but the cost of it enhanced, with some labourers refusing to work, McIvor had applied for 500 convicts to be sent to work on the government plantations, "I understand that Chinese convicts

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535 ARR, 1863–64. BPP, 1866:110.
536 AAR, 1864–65. BPP, 1866:163. Emphasis added.
537 AAR, 1864–65. BPP, 1866: 163. Emphasis added.
538 McIvor to J.D. Sim, Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 3rd November, 1864. BPP, 1866:79.

can be procured from the Straits Settlements;[539] these perhaps would be better suited to work in this climate than natives from the plains, and being generally good and careful cultivators, they will probably prove more useful."[540]

Like the 'lazy natives' of Assam (Sharma, 2009), McIvor characterized the available labour on the hills as "slovenly and careless", the labour shortage making coolies, "so independent that they dictate to their employers, and will only work during what hours they please and in such manner as they please" (in Sutton, 2009:95). The practice of organizing prisoners to perform manual labour (usually engaged in 'public works' like road or railway building)[541] had not become systematic or widespread until the beginning of the nineteenth century (Yang, 2003), and, as Northrup has noted, although Britain ended the assignment of European convict labour in 1838, it happily "sponsored or condoned similar practices with regard to non-Europeans for two decades more" (2003:128), and in this case for even longer. The movement of convicts from the Straits Settlements to the Nilgiri plantations took place in the opposite direction to the earlier and larger dispatches of convicts in the region. "India dispatched 4,000-6,000 convicts to Bengkulen[542] between 1787 and 1825 and 15,000 to the Straits Settlements between 1790 and 1860" (Yang, 2003:180). The Straits Settlements had aggregated the largest body of convicts and India now had a requirement for some of them.[543] Yang terms these indentured people, "convict workers", so as to, "underscore their roles as productive workers and to shift attention away from their criminal pasts, which previously misled considerations of their potential and effectiveness as workers" (2003:181). Placing an emphasis on convicts as workers here allows comparability with other forms of forced migration.

Mr. J. Rohde, Inspector General of Gaols had no objections to McIvor's proposal, stating that he should be disposed to relax discipline in the case of prisoners so

539 The Straits Settlements consisted of the individual settlements of Malacca, Penang and Singapore which came under the control of British India in 1826, becoming a Crown Colony in 1867. With the exception of Singapore the territories now form part of Malaysia.

540 McIvor to A.J. Arbuthnot, Chief Secretary to Government, Madras, dated Ootacamund, 8th July 1864. BPP, 1866:231.

541 Yang (2003:200-201) gives an account of convict duties in Penang. The majority were engaged in road construction, but a significant number of workers were also employed in the botanic and hill gardens.

542 Indonesia.

543 By September 1855 the number had reached 3,802 (Yang, 2003:198).

employed.[544] Their use was subsequently sanctioned by government, alongside a number of native prisoners, and McIvor was able to report in September 1865 that jails were under construction at all of the plantation sites, and one already completed at Dodabetta,[545] "the main room to contain 70 native prisoners, and eight of the verandah rooms to accommodate 30 Chinese prisoners, the other rooms being for the police..."[546] However, Rohde (a cinchona planter himself) became worried about the lack of progress when he inspected the jail at Naduvattam in late 1865.

> I particularly requested Mr. McIvor to take measures to hasten the work, and get the building ready by the end of the month, as I should not like to move prisoners in the southern districts after the 20th or 25th of December, when cholera generally prevails.[547]

He went on to make recommendations for the jail's capacity,

> ...each room of which measure 72 x 32 x ((16 x 32) / 2) = 42524 feet, or 83,048 feet in all, which divided by 564, the rate arbitrarily assumed in the Government Order (1241), gives accommodation for, say, 147 prisoners. My own opinion is that 200 might with equal safety be confined in the building, and the chances are that they would even then have, each, one-third more air than they had in the gaols from which they are transferred.[548]

The Naduvattam jail was completed by the close of 1865. Convicts had already arrived at the Dodabetta plantation, but the Government of Madras remained concerned about the wellbeing of the prisoners destined for Naduvattam, once they arrived in "...such a remote locality."[549] McIvor objected to the delay, reasoning that it would seriously retard the progress of the plantation.

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[544] J. Rohde, Inspector General of Gaols, to A.J. Arbuthot, Chief Secretary to Government, dated Ootacamund, 14th Jauly 1864. BPP, 1866: 231.
[545] Order of the Madras Government, dated 27th September 1865. BPP, 1866:179.
[546] AAR,1864–65. BPP, 1866:173.
[547] J. Rohde, to the Chief Secretary to Government, Fort Saint George, dated Ootacamund, 11th November, 1865. BPP 1866:232.
[548] *Ibid.*
[549] Government of Madras to the Secretary of State for India, dated Madras, 13th March 1866. BPP, 1866:213.

> Early in January, many of our free labourers will be leaving for their homes, upwards of 200 having already given notice to that effect, and those men will not return until the end of May or beginning of June, being in fact too late to prepare land for next planting season, I having depended on getting this work done by the convict labour during the months of January, February, and March; and if disappointed in this, it will form a very serious impediment to getting our nursery plants put out this season, while they will be too large to transplant the following season.[550]

Establishing powers to discipline convicts onsite was essential as the magistrate's court was over four miles from the plantation, and travel to it would, "...involve the loss of the entire day's work of the convict, together with that of the witnesses, on every occasion on which it was necessary to inquire into the misbehaviour of any one convict."[551] Problems were already being experienced with the Dodabetta convicts "in consequence of the prisoners having recently ascertained that there is no one on the spot with power to punish them,"[552] and in November 1865 a number of the prisoners demonstrated total resistance:

> On Monday the 13th instant, the whole of the convicts, with the exception of the Chinese, refused to perform their work, were highly subordinate, and insulting to the overseer in charge of the gang. On Tuesday 14th, this spirit became still more apparent; and on the 15th, we arranged to march the whole of the native prisoners to the court of the joint magistrate; but on applying to the police inspector for a sufficient guard for this purpose, it could not be supplied. Under these circumstances, the magistrate kindly visited the Dodabetta Gaol, and punished the less serious of the offenders on the spot, amounting to 56 in number, while 11 of the prisoners have been forwarded to the magistrate's court to-day, to be tried for more serious offences, such as criminal intimidation, &c. The prisoners have hitherto been cheerful and contented, and willingly performed their work, but a few bad men having instigated the others, they combined to throw off all control. In attempting to send a few of the first offenders into the station, they immediately feigned sick and would not walk, but lay down on the road, one here and another there, so that the men who were walking on, and who had laid down, could not be guarded by the police.[553]

This incident supports the acknowledgement by Scott (1985) and others that the power to resist constraint was open to both free and enslaved labour, as Northrup

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550 McIvor to Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 5th January 1866. BPP, 1866:235.
551 McIvor to the Inspector General of Gaols, dated Ootacmund, 3rd November 1866. BPP, 1866:233.
552 McIvor to Chief Secretary to Government, Fort Saint George, dated Ootacamund, 16th November 1865. BPP, 1866:234.
553 McIvor to the Inspector General of Gaols, dated Ootacmund, 3rd November 1866. BPP, 1866:233.

concludes, "the less powerful were not thereby powerless" (2003:130). Thirteen of the prisoners, seen as the instigators, were removed from the plantations to the Lawrence Asylum Works, after being sentenced by the magistrate to 60 lashes each, a punishment which was never inflicted.[554]

At Dodabetta, the inevitable consequences of "mutiny and insubordination"[555] led government to promptly award McIvor with the authority to pass punishment on 4th December 1865,[556] and peace was apparently immediately restored, just in time for Markham's return visit. Markham reported:

> The gaols are substantially built, and on an admirably devised plan both for health and security. That at Dodabetta consists of one, that at Neddivattam of two large and lofty rooms, with brick walls and roof, supported by beams of Angelly wood. Along each side, there are verandah rooms for dispensaries, offices, warders, &c., and the arrangements for guarding and inspection are very complete. The gaols have fire places, the bed places are wooden planks raised 18 inches from the ground, and each prisoner has a rug and two cumblies.[557] The drainage appears to be excellent. At the Dodabetta gaol there is a gaoler at 50 rupees a month, a head warder at 14 rupees, 4 warders at 10 rupees each (total salary 104 rupees), and 17 policemen for 82 convicts. At Neddivattam there will be 6 warders and 32 policemen for 200 convicts.[558]

Prison security arrangements were now apparently better in the hill jails than those of the plains, the probability of escape being "very small."[559] Mr. Dawson (a man of just 25 years old and an employee on the plantations for upwards of two years) was placed in charge of the Naduvattam plantation and the convicts that would work upon it in February 1866,[560] the convicts arriving on 16th May 1866.

After almost a year on the Dodabetta plantation, the prisoners had in McIvor's view been quite reformed owing to the geography of the plantation and jail and the

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[554] McIvor to the Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 5th January 1866. BPP, 1866:235.
[555] Clements Markham to the Secretary to Government, Revenue Department, For Saint George, dated Ootacamund, 16th January 1866. BPP, 1866:224.
[556] Order thereon, dated 4th December 1865, No. 1724. BPP, 1866:234.
[557] Blankets.
[558] Clements Markham to the Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 16th January 1866. BPP, 1866:224.
[559] Markham to the Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 16th January 1866. BPP, 1866:225.
[560] McIvor to Secretary to Government, Revenue Department, Fort Saint George, dated Madras, 19th February 1866. BPP, 1866: 237.

nature of the work in which they were engaged. Financial incentives offered for the completion of extra work, had been a marked success.

> They have maintained excellent health, and, after a short location upon the plantation, men weakly and delicate on their arrival become strong and robust. The nature of the labour is healthy, as also the situations of the gaols... The task of a convict on the plantation is that of a usual day's work of a free labourer. For all work performed over and above this task, the convict receives a reward equivalent to six pice for a quarter of a task, or two annas (3 d.) for a full task... This system of reward stimulates the convict to exertion, and teaches him the advantage to be obtained by constant and steady labour. The consequence is that nearly all the convicts, as they are released, get their families up from the plains, and settle down as free labourers on our plantations, an arrangement much more desirable than that they return to their previous haunts of crime, to be again exposed to temptation and the influence of evil associates.[561]

This representation of work as 'the route to civilization' was also applied to indigenous labour and to Tamil labour from the plains (Philip, 2003:84). As Yang explains, the transportation system in India, as in England, "was aimed at attaining the penal objectives of removing criminals from their local societies, or deterring others from committing crimes, and of reforming the convicts" (Yang, 2003:186), but also held added economic advantages. On the Nilgiri cinchona plantations transportation also fulfilled the objective of establishing the plantations – it is unclear whether the experiment would have been able to continue without them. Northrup explains that, although the conditions of service in the overseas colonies varied, "the perspectives of the laborers exerted a powerful influence on employers and colonial officials who were eager to persuade the indentured immigrants to stay beyond the terms of their first contracts" (2003:130). In the Straits Settlements, "Many convicts who served out their terms of transportation elected to remain in their host communities, their descendents becoming part of the significant minority that Indians constitute in the plural society of Malaysia" (Yang, 2003:204). Francis' history of Ootacamund confirms the legacy of convict labour in the Nilgiris. "... the natives still call the Government plantations the 'Jail totes' ... when their sentences expired a few of them settled down with Tamil wives at Naduvattam in a spot now known as 'the Chinese village', where they subsist as market-gardeners and dairy men" (1908:184).

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561 AAR, 1865-1866. BBP, 1870:51.

Despite the improbability of escape, a security breach at Nadvattam in 1866-67 was rendered inevitable:

> ...There have been two deaths, three escapes have been effected, and only one of the convicts recaptured. The men, as a whole, are healthy and contented, the deaths having arisen from diseases contracted in the plains, and the escapes effected by men of the wandering tribes who are impatient of restrain, and their habit of life renders them almost certain to evade recapture.[562]

New management practices were implemented to prevent further deaths and ill-health (also see section 7.3.3 below). "We have now erected a good hospital at some distance from the gaol, and it is anticipated that in our future reports, we will be able to show the health of the convicts at Neddivuttum much improved."[563]

The employment of convict labour on the Nilgiri plantations was discontinued on 31st March 1869, less than four years after it had begun, "...in consequence of the difficulty experienced in arranging them [convicts] so as to suit the convenience of the police guards, and at the same time perform a fair quantity of work. The convicts have done well for the plantations, and without them we could not have made the same progress at like cost."[564] This decision should not be regarded as a management failure as the convicts had only ever been intended to work the government plantations for the short term, during their establishment period, after which the jail buildings would perform alternative functions required for the next stage of the experiment. "On the departure of the convicts, the three handsome and substantial buildings at Dodabetta, Neddiwuttam, and Mail Koondah will be available for bark stores and manufactories."[565]

Following the cessation of convict labour, the plantations were worked by a permanent establishment of "well-trained gardeners, additional hands being merely called in to perform rough work."[566] However, entering the 1870s, McIvor (now subordinate to the District Commissioner - see above) was once again forced to

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[562] AAR, 1866-67. BPP, 1870:128.
[563] AAR, 1867-68. BPP, 1870:179.
[564] AAR, 1868-69. BPP, 1870:214. Private cinchona estates may also have used convict labour as the Magistrate in charge of the Ootacamund jail hired out 'surplus' convicts to private individuals (see Sutton, 2009:95).
[565] Markham to the Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 16th January 1866. BPP, 1866:225.
[566] AAR, 1872-72. BPP, 1877:112-113. We don't know where these gardeners were from.

rethink his system of labour management. Whereas the budget for 1870-71 had included allowances for an assistant superintendent, an overseer and 45 gardeners, cut backs for the following year instead allowed just ten rupees an acre per year for keeping down weeds, repairing roads and drains etc.[567] Government and the Commissioner appeared to have entirely forgotten the specialized nature of the task in hand.[568] Skilled and trained labourers were especially needed in the removal of the delicate bark from the trees (figure 7.2), and to make things worse the bark harvests were now increasing in size.[569]

The switch to working to fixed costs per acre rendered it impossible to maintain the trained establishment of staff.[570] Experienced staff at all levels of the hierarchy deserted the plantations and by the end of the official year 1872-73 McIvor described,

> ...it has been found impossible to perform with accuracy any operation requiring care and attention by the untrained and inexperienced men we are obliged to employ. The establishments on the plantations have now been reduced to one assistant superintendent, three overseers, and three maistries. Even in the higher grades all of our experienced men have left the department, with the exception of Narrainsawmy Naidu, who joined at the commencement of the undertaking.[571]

In the following year large tea gardens opened in the vicinity of the government plantations at Dodabetta and Naduvattam, and "as the Managers of these plantations give their men higher pay than we do, also warm clothing and permanent employment, the result is that the labour is drawn from our plantations."[572] It was hoped that improved accommodation (including the erection of 66 new huts and re-roofing the existing huts at Naduvattam) would attract labourers to the plantations. It was also suggested that garden allotments and an increase in wages[573] should be provided for coolies as additional draws.

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567 Commissioner of the Nilgiris to the Secreatry to Government, Revenue Department, Fort Saint George, dated Ootacamund, 20th April 1871. BPP, 1877:86.
568 McIvor to the Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 29th September 1866. BBP, 1870:105.
569 AAR, 1872-73. BPP, 1877:111.
570 AAR, 1872-72. BPP, 1877:112-113.
571 AAR, 1872-73. BPP, 1877: 113.
572 AAR, 1874-75. RBGK. MRMC, 1861-85.
573 Revenue Reports. Webster (Acting Commissioner) to Master (Secretary to Government), dated Revenue Department, 31st December 1877:5. RBGK. MRMC, 1861-85.

Figure 7.2 - Harvesting Cinchona Bark, Ceylon, 1880s by John Abercromby Alexander

Source: RCS, CUL. GBR/0115/Y303E. Print 47. Photograph collection of John Abercromby Alexander.[574]

Relief actually came from the famine that struck much of southern India in 1877.[575] As neighbouring districts experienced severe hardship, the Nilgiris became flooded with labour. Signs of weather induced movement of free labour had first been experienced in 1866 as McIvor reported, "...many of the labouring population of the Mysore country having been induced by the scarcity of provisions to leave their homes and visit the hills in search of employment,"[576] but the movement to the hills in 1877 was on a much larger scale,

[574] Although this image comes from Ceylon, the harvest of bark on the Nilgiri plantations operated in a very similar way. John Abercromby Alexander (b. 1854) was appointed as a forester in Ceylon in 1885, although he had possibly lived there longer, engaged in planting enterprise. He served as Assistant Conservator of Forests, Central Province between 1889-1893, he joined the Royal Colonial Institute in 1892 and lived in Travancore, India between 1896-1898, and then returned to England before taking a post in Portuguese East Africa. See: http://janus.lib.cam.ac.uk/db/node.xsp?id=EAD%2FGBR%2F0115%2FY303E [accessed 14/01/10].
[575] The 1877 famine was the final in a sequence of famines which struck India between 1860 and 1877. Triggered by two years of drought and exacerbated by the export of grain to Europe, the famine caused 3.5 million deaths. Confusion over the management of the famine resulted in the formation of an Indian Famine Commission (1878-1880) and the drawing up of a Famine Code in 1880 which was to become the basic format of famine relief until the 1970s. For more see Brennan,1984 and Davis, 2002.
[576] AAR, 1866-67. BPP, 1870:128.

> We have a large imported body of coolies[577] numbering over 15,000 employed in the valley on the plateau and on the slopes. In ordinary seasons, four-fifths of this multitude would return to Mysore, during January, February and March each year and troop back again to the estates about June, July and August. The scarcity prevailing in that Province has proved a check to the ordinary course of events and the keep of these people bids fair to be an additional burden on the food resources of the Hills. Employment must be found for them during the next three or four months...[578]

A week later the District Magistrate issued a circular to the planters, requesting them to take on additional labour at a lower wage.[579] Prevailing notions of famine centred on people's tendency to become dependent on relief instead of working for themselves. Official aid was thereby limited (Hall-Matthews, 1996). The rate of daily pay was debated over the next few months, in accordance with the minimum amount people could survive on without their strength being so reduced to the extent that they were unfit to work.[580]

But labour difficulties had not been relieved permanently. The following year, trials of increased wages and the issuing of grain at market rates failed to have the desired effect and at Naduvattam and Pykara only half the required number of coolies could be found. "...many of the Canarese who had been supported throughout the famine ran away as soon as prospects became better in Mysore. The chief maistry who had a gang of 200 coolies died during the year, and in consequence many of his coolies made off".[581] To make things worse it was now the Nilgiris experiencing the unfavourable weather:

577 The term 'coolies' was first applied to South Asian labourers who were recruited to Indian Ocean sugar plantations as replacements for African slaves, "...believed to originate from the Tamil word for wages 'kuli'. It long denoted workers at the lowest rung of the Indian Ocean labour market" (Sharma, 2009:1306). The term conceals the large number of women and children who worked on the plantations (see figure 3.7).

578 BL. *SIO*. 7th February 1877. p.3.

579 BL. *SIO*. 14th February 1877. p.6.

580 BL. *SIO*. 17th February 1877. p.3.

581 Barlow (Commissioner) to Garstin (Acting Secretary to Government), dated 10th July 1879:6. RBGK. MRMC, 1861-85.

> "During the wet months the roads to the Neddivattam and Pykara Plantations became impassable for cart-traffic, so that grain could not be got out for supply to the labourers employed in those estates which are situated 22 miles from Ootacamund... An experiment was tried to introduce laborers from Coimbatore and Collegal; but this also failed owing to the climate and the work on the plantations being unpalatable to the men who were of the weaver caste, and who all absconded."[582]

Fortunately weather soon improved, and although it now cost more than before, entering the 1880s labour was sufficient, now comprised predominantly of members of the local hill tribe known as the Badaga.[583] However, overall, "Hill communities were consistently and notoriously unwilling to become wage labourers" (Sutton, 2009:96), and in 1881:

> To obviate the difficulty experienced during crop time by the Badagas absenting themselves to attend to their fields, &c., an attempt was made to get up low-country labor with perfect success. Although both the climate and work were quite new to them, they took kindly to the place and are fast becoming experts in barking, &c. They are a better class of labor than the Badagas, the latter being too independent.[584]

Permission and funds were given for the completion of additional tasks (including uprootals)[585] on the government estates in order to take advantage of the now plentiful staff. Heidemann's description of the labour migration system is useful here:

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[582] Revenue Reports. Barlow (Commissioner) to Master (Secretary to Government), dated 5th October 1878:4. RBGK. MRMC, 1861-85.

[583] The Badaga are thought to have settled on the Nilgiris soon after 1565, when "their status began to change from that of landless refugees to a more dominant one, millet farmers who produced a food surplus that could be bartered with the neighbouring Toda, Kota, Kurumba and Irula tribes... By the eighteenth century, the Badaga population had become the largest of any on the hills... Their mixed farming and cattle herding economy must also have been by then a dominant factor in the life of the district" (Hockings, 1997:3). They introduced settled agriculture to the hills and began the cultivation of a wide variety of crops like ragi, wheat and barley (Prabhakar and Gadgil, 1996). In the first half of the nineteenth century, the Badagas had been praised for their agricultural abilities, but by the end of the century as Sutton explains they were, "condemned as destructive parasites on the colonised landscape of the hills", apparently guilty of environmental crimes (2009:106).

[584] AAR, 1880-81:4. RBGK. MRMC.

[585] AAR, 1881-82. RBGK. MRMC.

> The labour recruiter, called *maistry* or *kangany*, played a crucial role in the migration process and became a central figure among Tamil labourers on plantations. Prior to his plantation job, he had some connection with British officials or planters and recruited mainly from his own or his wife's village or from the local market towns. Therefore the labour force of a plantation originated from the surroundings of the kanganies' native villages, which were scattered in the plains. Most labourers were thus recruited from various Tamil districts... As in other parts of India, many migrants left their families behind, visited their homes annually, and considered their stay in the Nilgiri Hills as temporary (1997:149).

Etemad draws similarities between this system of 'free' contracted labour and slavery on the island of Java. "The 'free' workers on the Javanese plantations could not get out of this commitment without being subject to severe penalties and corporal punishment" (Etemad, 2007:31). In a footnote Etemad records that on a plantation employing 400 indigenous persons, 120 deaths were recorded in 1897, and that in 1917, the number of deaths among 245,000 workers employed on 300 enterprises was 2,500 or a rate of ten percent.[586] Likewise Philip suggests that the political geography of south Indian plantations, in sparsely populated and isolated hill tracts, "made possible a disciplining of labour that was almost absolute" (2003:81). This may be true, but on the Nilgiris it also seems to have been near impossible for the planters to retain coolies from one season to the next and, "there were constant problems with defaulting labour contractors and absconding workers" (Morrison, 2004:68).

The planter's perceived need for more control prompted the formation of their representative body the United Planters Association of South India (UPASI) in 1893. But even after laws were altered in 1903 to give employers greater control, "the situation never even remotely resembled the appalling abuse of Bihari tea-garden workers in Assam by their contractors and employers" (Morrison, 2004:68).

The Naduvattam plantation continued to operate using the system of recruiting migratory labour through *maistries*, but Dodabetta (as the less remote location) returned to using the indigenous Badagas. As was the case in the Assam tea industry, "The prominence of 'imported' coolie workers has obscured the significance of various local groups as well as the tea industry's importance in the

[586] Etemad's figures are taken from: Cloetta, A. Le problem economique et social de la quinine. PhD thesis, University of Geneva. 1928.

local 'imagination'" (Sharma, 2009:1287). The Badagas use of cattle denoted their superiority amongst the Nilgiri hill tribes in agricultural matters. 'Jungley' or aboriginal or hill labourers were among the most prized in the labour market, "raked highest for resilience, labouring ability, and resistance to disease" (Sharma, 2009:1307), although these conceptions were always shifting.

The division meant that in the official year 1882-1883 labour at Dodabetta was scanty whereas that at Naduvattam was excessive. The scarcity was due to the number of private plantations recently opened up at Dodabetta, "the proprietors of which pay the Badagas more than we do", whereas at Naduvattam, the number of coolies contracted had proved too excessive for the estate's requirements. The Superintendent explained that, "...in the new agreements I have contracted with the Maistries for the smallest number possible, casual daily labor to be employed in cases of emergency, and I have also inserted a clause in the agreements to the effect that, if necessary, the Maistries must work on the Dodabetta side."[587] The plantations continued to make use of both hill tribes and imported labour on their estates and it was not uncommon for the two groups to work alongside one another (Heidemann, 1997). In the north of India convicts were once again utilised in the cinchona experiment in the 1890s, but his time they remained in their existing jails and were used to put together the farthing packets of quinine. At the great jail at Alipore, Calcutta:

> In huge piles of glittering white, on great tables in long cells, tower some two thousand pounds weight of the sulphate of quinine. It is rapidly weighed out in five grains and placed on the open papers, the outside of which is printed in the Bengali, or Orissa, or Santali, or Hindi, or other vernacular languages of the enormous province and of Assam, giving directions for use. By deft hands these papers are closed, by a third set they are packed, and by a fourth the boxes are despatched to every post office over a land half the size of Europe (Anon, 1897c:6).

Sharma (1997) raises an interesting issue regarding the impact which living in the medical plantation industry would have had on the cinchona plantation workers. Actively engaged in the production of western medicine, the workers would have

587 AAR, 1882-83. RBGK. MRMC. Remember that the two plantation sites were a significant distance apart and it was no simple process to transfer labour from one site to another, the remote Naduvattam site being unpopular amongst labourers due to its remoteness.

been influenced by its concepts, perhaps challenging their own outlooks on health and hygiene. However, in 1871 Elliot urged that government force Indian villagers to raise cinchonas as they simply did not know for themselves the advantages of doing so.

British planting efforts on the Nilgiris certainly left behind a legacy. The Nilgiris became "the most polygot area in the [Madras] Presidency" (Francis 1908:124), and "the labour migration strengthened the link to the surrounding plains and introduced new ideas and ideologies" (Heidemann, 1997:148). As Hockings recently documented, "Today most of such Nilgiri ethnic groups [Todas, Nayakas, Kurumbas etc], who led an itinerant foraging life before, are employed on tea, coffee or rubber plantations" (Hockings, 1997:4).

7.2 The Cinchona Year

In common with all plantations, specific tasks on the cinchona plantations required completion at certain times of the year, making some months busier and requiring a larger labour force (i.e. harvest time), than others. Activities were largely timed in accordance with the seasons and expected weather on the Nilgiris (alongside the availability of labour discussed above), although the weather was not always predictable. As was the case with coffee planters in the highlands of Ceylon, "Planters... were very aware of the ability of the non-human, be it wind, rain, drought, or disease to frustrate their plans... under the influence of environmental determinism and theories of tropical degeneration, mid-nineteenth century European imaginations ceded to the physical environment even more power than it in fact had" (Duncan, 2007:4). Numerous instances of disruption and destruction from the weather are highlighted in the annual reports (section 7.3). The aim of this section is to give an account of what needed to be done on the plantations and when, establishing how the cinchona itself was managed on the Nilgiris.

The Indian Meteorological Service divides the year into four seasons, and it makes sense to deal with the plantation tasks using the same division. These seasons are, i) the relatively dry, cool winter from December through to February; ii) the dry, hot summer from March through May; iii) the southwest monsoon period from June through September; and iv) the northeast, or retreating, monsoon of October and

November. Today, as in the years of the cinchona experiment, "Because of the critical importance of monsoon rainfall to agricultural production, predictions of the monsoon's arrival date are eagerly watched by government planners and agronomists who need to determine the optimal dates for plantings."[588]

The timing of specific tasks is often not immediately apparent from the official AARs, but fragments of information from these reports have here been combined with newspaper accounts and other sources to build up a general picture of the cinchona year. Every year was different, not only because of the changeable timing of the rainy and dry seasons, but also because tasks changed as the plantations grew, and as different men directed the activities as they saw fit. In the early stages of the experiment much of the labour time was devoted to tasks like; clearing jungle vegetation to make way for the cinchona plantations, enclosing the plantation sites, constructing roads to them, and to propagating the young plants. The focus next moved to planting up, then and as time went on more hours were set aside for weeding, manuring and general upkeep of the plantations, and then to harvesting the bark from the mature trees.

7.2.1 Winter – December to February

Winter could be a trying time on the cinchona plantations with hard frosts a frequent occurrence. In late December 1878 and early January 1879 hard frosts caused considerable damage on private estates.[589] Short but heavy frost in mid-January 1881 again seriously injured the cinchona around Ootacamund:[590] "...on the Dodabetta plantation a few trees growing in the flats were killed. Young private plantations in Ootacamund did not suffer in winter so much as in the previous year, owing perhaps to the fact that their owners had raised five [fine] belts of Blue-gums to protect their plants."[591] A severe frost in January 1896 rendered the harvesting of a large quantity of Dodabetta bark compulsory, the frost having killed over 3,000 trees.

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[588] http://www.indianchild.com/climate_india.htm [Accessed on 16/01/10].
[589] Barlow (Commissioner) to Garstin (Acting Secretary to Government), dated 10th July 1879:3. RBGK. MRMC, 1861-85.
[590] BL. *SIO*. 15th January 1881. p.8, col. B.
[591] AAR, 1880-81:1. RBGK. MRMC.

But this was also the 'dry season', and could be warm, bleak and unhealthy as Standen reported in 1898. "The dry season [December to March] was one of the hottest and driest on record, the cattle suffered considerably from want of sufficient pasture, and there was an unusual amount of sickness among the coolies."[592]

The end of winter was the usual time for the annual crop of bark from the government estates to be dispatched to London for sale, with private planters usually following the government's lead. However, bark bales could be dispatched at any time. In 1877 a large amount was dispatched in December[593] the *SIO* noting the activity to be occurring three months earlier than usual. The newspaper urged a note of caution, "The excessively wet weather we have had for some months, makes it extremely unlikely that the Government bark can have been properly dried, not withstanding artificial appliances for that purpose. The ware-housing and shipment can but help the deterioration of the insufficiently dried bark."[594]

However, weather was not the only factor in triggering the dispatch of bark, the auction prices having an at least equal determining role. The New Year was, however, generally the busiest time for the fortnightly London bark market, with large quantities of Indian grown bark offered for sale[595] and planters on the Nilgiris eagerly awaiting the latest price reports. Records would often be set in the January auctions.[596] January was the month chosen for the first official auction of government cinchona bark in Madras in 1882, where 10,000 lbs of cinchona bark were offered in lots of about 100lbs each.[597] This was also the month when half yearly reports would be issued.

With the annual crop of bark dispatched, the remainder of winter was quiet on the cinchona plantations, and many of the labourers from the neighbouring district of Mysore returned to their homes to tend to their own crops (to return again around June, July or August). During years when more men were required during the winter months, new sources of labour were sought out to cover the period where

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592 AAR, 1897-98.1. RBGK. MRMC.
593 BL. *SIO*. 12th December 1877. p.5.
594 BL. *SIO*. 12th December 1877. p.5.
595 For example see: BL. *SIO*. 27th February 27th 1878. Additional unnumbered sheet, col B, and *SIO*. 11th January 1879. p.7, col. A.
596 BL. *SIO*. 7th March 1877. p.5.
597 BL. *SIO*. 17th December 1881. p.1 col. A.

the regular labourers were tending to their own crops.[598] Later in the course of the project, the government plantations experimented with early planting, beginning at the end of February, which offered the benefits that the plants would be well rooted before the monsoon burst, and get the advantage of two growing seasons before the commencement of the dry months of winter and spring.

7.2.2 Summer – March to May

The plantations sprang into life during the summer season, planting typically taking place between March and August. McIvor planted the very first cinchonas in the open in May 1861.[599] As soon as cinchonas were growing in the open, McIvor was regularly instructed to send specimens of their bark and wood, dried leaves, decoction and infusion, to the Secretary of State for India for submission to Howard for analysis and report. These samples were usually taken annually in March or April,[600] "or as the sap begins to rise, as this is the season the bark separates freely from the wood" (Anon, 1866:419).

Once the trees had reached productive age, bark was harvested on a larger scale during the summer months, and experiments conducted into the best method of harvesting.[601] Yet summer did not guarantee an easy harvest. A severe thunderstorm on the 29th March 1883 caused fearful havoc amongst the trees. The bad weather rendered the harvesting of bark extremely difficult and stripping had to be abandoned (as the bark could not be 'lifted' without damaging the trees), in favour of coppicing and uprooting. The impact on the plantation coolies was concurrently very unfavourable[602] (see section 7.3 below). As the size of the harvest emerged in May, government would invite tenders for the carriage of bark and stores from the plantations to Ootacamund, and vice versa and for cartage to Metapollium.[603] Dispatching the harvest was not an easy process, carts had to be hired and shipping agents procured. For many years, the bark grown on the Nilgiris was shipped back to the London market to be sold and the methods of

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598 AAR, 1880-81. RBGK. MRMC.
599 McIvor to Pyecroft, Chief Secretary to Government, dated Ootacamund, 20th January 1862. BPP, 1863:197.
600 For example see letter from Charles Wood to The Government of Madras, dated India Office, 8th August 1864. BPP, 1866: 47.
601 For example, experiments in coppicing were directed to be carried out in May 1879. See G.O. reproduced in BL. *SIO.* 3rd May 1879. p.6, col. D.
602 AAR, 1882-83. RBGK. MRMC.
603 BL. *SIO.* 6th May 1882. p.9, col. A.

packing and transporting needed scientific refinement as in this arena as in every other, the planters started out very much in the dark.

The Ooty 'season' (when large numbers of visitors arrived to fill the hotels and escape the heat of the plains) reached its height in April, and this was then many government officials chose to visit the cinchona plantations. Good weather was common but still not guaranteed and heavy April storms could damage the young cinchona.[604] It was also the month when the budget for the forthcoming year was announced.

In the late 1880s, the production of hay on the estates was expanding rapidly, another job to be completed during the summer months. In 1889: "Five and one-third tons of hay were made on the Dodabetta estate and this was readily purchased by the public. In fact, the supply was not anything like equal to the demand, and many applications for it had to be refused. At Naduvatam a ton of root grass was harvested in April."[605]

7.2.3 Southwest Monsoon – June to September

Seedlings and young plants from both government and private nurseries were typically available for delivery to plantations during these months. Advertisements sometimes placed ahead of the actual availability of goods, "For sale in June – Plants of Chinchona Condaminea. Price per thousand Rs 20 for cash. 12 beds of seedlings of C. Condaminea. 10 beds of seedlings of C. Succirubra. Price per bed estimated to contain one lakh, more or less, Rs 300 for cash. Apply to R.L. Shubrick, Ootacamund. 22nd March, 1878."[606] The *SIO* reported on the rush of activity that the early southwest monsoon season brought in 1880:

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604 Revenue Reports. Roupell (Acting Commissioner) to Secretary to Government, dated 25th September 1880:1. RBGK. MRMC, 1861-85.
605 AAR, 1888-89:4. RBGK. MRMC.
606 BL. *SIO*. 3rd April 1878. p.1, col. C. Also see *SIO*. 6th July 1878. p.1, col B.

> The past few days of fine planting weather has caused quite a rush upon the Government chinchona nursery, at Neddiwuttum. Hundreds of coolies from the Valley and from Superintendents in Wynaad are daily waiting to convey, bespoken Chinchona seedlings to their destination. Some millions of Chinchonas will find a home this year in that part of the District.[607]

From 1866 cinchona seeds also became ripe and ready for distribution to planters in this quarter. McIvor reported of the seeds distributed in 1867, "Reports daily reach us of their excellence, and the great number of young seedlings raised from them."[608] Planting of new stock (in both seed and seedling form) was thus undertaken in preparation for the rains, and experiments into the best pattern of planting conducted.[609] Weeding, manuring and general upkeep tasks were also carried out.[610] On the last day of July yearly plantation reports were issued to government, the contents of which would not be made public for several months.

This was also the season to make extensions to the plantations as the *Illustrated London News* described in 1862 (Anon, 1862b). The planting ceremony pictured in figure 6.9 took place on the 30th August 1862. Barking the trees appears to have often continued into September and October.[611]

The main auction season for Indian bark was now beginning, and in 1885 Lawson announced:

> ...in future, sales of cinchona bark on account of government will be held [at Madras] on the first Monday in each of the four months of September, October, November and December; the sales will be by public auction and the Government guarantees that for the next two years the quantity offered will not be less than 70,000lbs, per annum in quantities of not less than 17,500lbs at each of the four monthly sales...[612]

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607 BL. *SIO*. 31st July 1880. p.9 col. A.
608 AAR, 1866-67. BPP, 1870:122.
609 These focused on the distance between trees, with McIvor changing the pattern from planting trees ten feet apart, to just six or eight feet. See McIvor to J.D. Sim, Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 7th July 1863. BPP, 1866:13.
610 BL. *SIO*. 6th February 1878. p.5, col. B.
611 Bidie's notebook. RBGK. JEH/1/47.
612 BL. *SIO*. 1st August 1885. p.9, col. C.

7.2.4 Northeast Monsoon – October to November

It was common for new plants from England to arrive on the Nilgiris in the autumn (in spite of the hills often experiencing heavy rain at this time), that being the period considered safest for the journey, after maturing during the English summer and reaching the Red Sea during its coolest period.

Bark harvested during the year and not yet dispatched was now being dried. In October of 1877 the *SIO* described the activity. The drying house on this estate was:

> ...capable of receiving tens of thousands of pounds of bark at a time, upon the shelves of its pandals, rising above the brick furnace, which is fired with wood, and where the bark is dry within a week", and bark then packaged, "The grey "natural" or the black "mossed" or the yellow "renewed" is put into a packing box lined with the cloth of the intended bale, and a hundred pounds are compelled to take the least possible space by means of the pressure brought to bear on the mass of bark by the packing apparatus. The door of the box being opened, the package is taken out, thoroughly sewed up, labelled, and making less than a hundred and twelve pounds, is entered in the book ready for England and quinine.[613]

Although the withdrawal of the monsoon is overall a far more gradual process than its onset, the Nilgiris receive most of their rainfall from the northeast monsoon during November and December,[614] presenting difficulties for newly arrived plants struggling to acclimatize to their new home, and for drying the bark thoroughly before shipment to London.

The natural environment largely determined the structuring of the cinchona year, and it is the problems and possibilities offered by the natural conditions and characteristics of the Nilgiris that are dealt with in section 7.3.

7.3 Environmental Constraints

MacLeod suggests that perhaps the most important impulse to the support of 'scientific method' in India, "was the prevalence of specific problems which seemed susceptible to scientific solution – including epidemic disease, insect pests, poor

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613 BL. *SIO*. 10th October 1877. p.6.
614 http://www.indianchild.com/climate_india.htm [Accessed on 16/01/10].

sanitation, and poor agricultural yields" (1975:350). For the European planter on the Nilgiris: "...nature was everywhere: in the ground underfoot, rich in potential but thickly forested and in need of harnessing; in the vegetation around, which had to be cleared to make room for plantation residencies and their English flower gardens; in the climate, with its fierce monsoons, leeches and tropical insects" (Philip, 2003:90).

Nature needed to be made amenable to the planters, and "ordered to specific ends" (Philip, 2003:90). In most cases, it was believed that the professional botanists or "scholar-officials could lead the colony through a complex nexus of nature where problems of soil, plants, acclimatization, labor, and colonization all interacted" (Goss, 2004:90).

7.3.1 Climatic Challenges

Cultivating cinchona was demanding of climatic conditions, altitude and soil type (Etemad, 2007). As soon as they were removed from their natural home in South America, cinchona plants and seeds had to face the full force of the new environments into which they were transported. Even inside their Ward's case, the weather the plants experienced en route to the Nilgiris was often said to determine their likelihood of survival. Unscheduled stoppages in the Red Sea, "the hottest of all hot places"[615] was highlighted as a contributing factor to the demise of Markham's plants in 1860, whereas the "cool and kind Red Sea"[616] was seen to have contributed to the survival of Cross' consignment in 1861.[617]

Upon reaching the Nilgiris, the climate, now famed for its salubrity (see chapter 4), presented its own challenges for the cinchona. The weather was not at all kind to Markham's already suffering plants, a particularly heavy northeast monsoon destroying all hopes of survival.

Rainfall and temperature gauges were introduced at each of the government plantations, and each season was judged favourable or unfavourable on the basis of

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615 MMD, entry for 16th September 1860. RGS. CRM/23.
616 The Red Sea was seen as a particularly dangerous part of the journey throughout the experiment. When Adolf Biermann's plants died at Ooty in 1879-80, he recounted that "The plants began suffering in the Red Sea..." See Biermann to Dr. Young(?), dated 2nd February 1880. RBGK. IEPC.
617 Government of Madras to Sir Charles Wood, dated Madras, 24th April 1861. BPP, 1863:164.

the data recorded. By and large the cinchona proved to be a more resilient crop than first assumed. Nevertheless a number of 'unusual' or prolonged weather events impacted on its growth, and measures were sometimes introduced in attempts to 'manage' future events. Government and private planters alike relied on the south-west and north-east monsoons to water their crop, and the planting year was planned in accordance with their appearance (see above). When monsoons were unusually violent in character, or failed to emerge, problems emerged. In McIvor's annual report for 1865-66 he reported that the trees planted by Sir William Denison in 1862 (figure 6.9) were suffering after an adverse season involving protracted drought, high winds and a violent south-west monsoon.[618] As more and more forest land was cleared for cinchona cultivation McIvor surmised that:

> ...when forests are felled, the supply of water is increased in volume from two to three times, according as the streams rise in, or receive their supply from land occupied by forest, and as this increased flow of water has been permanent for five years, it cannot be the result of any accidental peculiarity or accidental circumstance.[619]

The following year was fortunately much more suited to planting, the rains arriving earlier and extending to a later date, the most favourable year for cinchona since the commencement of the experiment. In 1868-69 McIvor was similarly able to report that considerable progress had once again been made, largely because the rains of both monsoons had been more copious than usual, and more regularly distributed.[620]

The 1870s were a much more calamitous decade, not only for the cinchona, but for labourers too (see below). In 1873-74 seven acres (comprising 7,000 large trees of seven year's growth and 23,000 younger plants) were destroyed by frost on the private Ossington estate which adjoined the Government plantation at Naduvattam. It had been too dry for barking, and not so much bark was taken as anticipated. However, in 1877, the cinchona survived against the odds. As Davis' comprehensive study explains, "The life-giving southwest monsoon had already failed much of southern and central India the previous summer. The Madras Observatory would record only 6.3 inches of precipitation for all of 1876 in contrast

[618] AAR, 1865-66. BPP, 1870:48.
[619] AAR, 1865-66. BPP, 1870:49.
[620] AAR, 1868-69. BPP, 1870:210.

to the annual average of 27.6 inches during the previous decade" (2002:25). Grain riots, and a deep depression in trade, were accompanied by continued exports to England. "The newly constructed railroads, lauded as institutional safeguards against famine, were instead used by merchants to ship grain inventories from outlying drought stricken districts to central depots for hoarding...Likewise the telegraph ensured that price hikes were coordinated in a thousand towns at once, regardless of local supply trends" (Davis, 2002:26).

In a retrospect of the year 1877, the planter's sheet of the *SIO* noted how in a year marked with hardships, cinchona cultivation had been attended with great success, largely owing to the presence of civil unrest in a number of locations across the world. "The better varieties of Cinchona bark realized extravagant prices, and a perfect furore for cinchona cultivation set in, which continues and bids fair to contend with coffee for the palm". However, although cinchona had faired better than tea and coffee in the dry weather, "...injury was not the less apparent. The bark refused to lift with the same ease as in more favourable seasons – and renewal was tardy even where certain."[621]

Huge amounts of planting had taken place in Ootacamund and its surrounding area during recent years, and the *SIO* surmised that this vegetable growth might be responsible for the current dry weather: "Is it possible that the trees acting like so many pumps are absorbing and dissipating the moisture which formerly was retained in the soil?"[622] There may well have been more work available during dry seasons, certainly in 1866 during a long drought, the government plantations had had to resort to the labour intensive process of watering the cinchonas by hand.[623]

Still, somehow the government bark harvest of 1877 was dispatched to London three months earlier than normal.[624] However, as the drought conditions continued, the laboring population became increasingly unfit for estate work. The impact of the famine on labour supply was to be long lasting, the *SIO* reporting in December of 1878 that "although the actual want of labour has not been hitherto felt, the

621 BL. *SIO*. 8th January 1878. p.5, col. B.
622 BL. *SIO*. 7th March 1877. p.5-6.
623 Order of the Madras Government, dated 9th February 1865. BPP, 1866:115.
624 BL. *SIO*. 12th December 1877. p.5.

impoverished condition of the people employed has added so much to the cost of the estate work."[625]

Although 1878-79 was generally more favourable for cultivation, in late December 1878 and early January 1879 hard frosts killed a few small plants at Dodabetta, and caused considerable damage on private estates,[626] the weather in general too mild for the collection of a large crop of bark. Battles with the weather continued when a violent hailstorm on the 12th April 1880 damaged 28,259 *Cinchona succirubra* on the Hooker plantation which had to be subsequently uprooted, and replaced by *Cinchona officinalis* as it had since been determined that planting in a mixture limited damage from storms.[627]

Prolonged poor weather combined with a severe lack of superintendency, resulted in the government plantations falling into a state of disrepair. As the *SIO* issued on the 24th July 1880 reported of Dodabetta,

> To a private proprietor the state of affairs would be a state of anxiety, if not of alarm. The whole plantation is overrun with that stringy moss which augurs decay, every bough and twig is covered with it, and the lower ones already form dead wood...The condition of the plantation has attracted attention, and those who would have invested their capital in Cinchona would wish to be informed whether such a state of things can be disregarded, or whether it means ruin and loss, sooner or later. The absence of information from Government, scientific or practical, on Cinchona Culture has been very marked of late.[628]

Short but heavy frost in mid-January 1881 worsened the situation, seriously injuring the cinchonas around Ootacamund.[629] The following year, high winds and rain had a dramatic effect on the *Cinchona succirubra* at Naduvattam and Pykara, Gass (Deputy Conservator of Forests and Acting Superintendent), noting their "very bare and sickly appearance", casualties amounting to 15,250 trees.[630] Strong winds were often considered to be the most damaging weather element, and

[625] BL. *SIO.* 14th December 1878. p.5, col. A.
[626] Revenue Reports. Barlow (Commissioner) to Garstin (Acting Secretary to Government), dated 10th July 1879:3.
RBGK. MRMC, 1861-85.
[627] Revenue Reports. Roupell (Acting Commissioner) to Secretary to Government, dated 25th September 1880:1.
RBGK. MRMC, 1861-85.
[628] BL. *SIO.* 24th July 1880. p.9, col. D.
[629] BL. *SIO.* 15th January 1881. p.8, col. B.
[630] AAR, 1881-82:3. RBGK. MRMC.

increasingly "...the Australian wattle (*Acacia decurrens*), celebrated by poet Henry Lawson and many since as an emblem of nationalist [Australian] pride, was pressed into colonial service abroad as a 'nurse crop' and windbreak for tea and cinchona plantings..." (Sharrad, 2007:37).

Bad weather could also damage the infrastructure needed to keep the plantations up and running. This happened when a severe thunderstorm struck the Nilgiris on 29th March 1883, causing fearful destruction amongst the trees and additionally:

> ...enormous damage was done to our roads, bridges &c., and also buildings... As our Chinchona estate coolies were the only Government ones on the Naduvatam side, we used a number of them in working a raft on the Pykara river in bringing over the mails and in clearing away the worst of the landslips, and I venture to think they were of considerable assistance.[631]

The weather rendered the harvesting of bark extremely difficult, and stripping was eventually abandoned (as the bark could not be 'lifted' without damaging the trees), in favour of coppicing and uprooting, but this was not before the labourers were subjected to great suffering.

> The coolies in collecting bark had a very bad time of it, as being obliged to remain on the same spot exposed to wind and rain, their limbs became quite numbed, and they frequently had to be carried home after a few hour's work. We had, however, no deaths among our coolies, though many corpses of travellers were buried by our people.[632]

At the close of the year 1882-83, "the plantations of Naduvatam, Hooker and Wood presented a wretched appearance."[633] Firewood for the furnaces on the plantations was lacking as an extensive nursery of eucalyptus had been completely destroyed by the rain. Instead, "The firewood for the furnaces during the year was obtained partly from the stumps of uprooted trees and partly from junglewood cut within the boundaries of the estate..."[634]

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631 AAR, 1882-83:2. RBGK. MRMC.
632 AAR, 1882-83:2. RBGK. MRMC.
633 AAR, 1882-83:3. RBGK. MRMC.
634 AAR, 1882-83:10. RBGK. MRMC.

In 1884, an unprecedented frost during the second week of the year played sad havoc among the young cinchonas at Ootacamund. The *SIO* feared it might be the final blow. "Trees of considerable size have been quite burnt up and permanently injured...We fear that the damage done during the past week will be a death blow to planting cinchona on the Nilgiris as it is clear that it does not find a congenial habitat at such an altitude."[635]

The variation in weather conditions between the Naduvattam and Dodabetta sites becomes apparent over the course of the experiment; if one plantation was struck hard, the other usually escaped damage. The frost which occurred in January and February 1888 proved to be very destructive to the trees on many of the plantation plots at Dodabetta, whereas the gloomy year 1892-93 struck the western side of the plateau hardest (the Pykara and Naduvattam estates), those plantations experiencing drought conditions from October 1892 to the end of the year.[636] In the dry conditions, fire broke out on the plantations near the Chinamen's lines at Naduvattam but fortunately only limited damage occurred.

Several jungle fires swept through cinchona estates in the Wynaad during 1896, and, "by means of the long dry grass at the base of the trees, passed between the cinchonas, burning the leaves and scorching the bark..." However, "...the bark was only superficially smoked or blackened; the epidermis layers were intact, and the cambial cells had not been reached by the heat."[637]

In the 1890s, new plants began to struggle, owing, it was supposed, to the second hand land on which they were planted (land on which cinchona had been grown before).[638] In the first essay of *Tropical Nature* (1879), Wallace had argued that, "if not checked in time and without reforestation, plantation agriculture would lead to a deterioration of the climate and the permanent impoverishment (and starvation) of the indigenous inhabitants" (Stepan, 2001:81). The large scale clearance of forests necessary for the establishment of plantations destroyed the fertile soils which had taken generations to form. A new strategy of leaving more weeds, attempted to preserve the nutrients of the soil. Additionally all the estates were now well

[635] BL. *SIO*. 12th January 1884. p.10, col. B.
[636] AAR, 1892-93. RBGK. MRMC.
[637] AAR, 1896-97:6. RBGK. MRMC.
[638] AAR, 1894-95. RBGK. MRMC.

provided for with manure. Lawson explained the crucial importance of manure to replenish the soils, "It cannot be brought forward too prominently that on old estates like these belonging to Government, where much of the richer soil has been used up or washed away, deep tilling and a liberal application of manure are indispensable."[639] In addition to the application of manure, phosphates were applied to areas of the plantations to enrich the soil from 1896.[640]

In 1898, a small plot of land (around two acres) was cleared and planted with new seed from Jamaica, in order to allow the observation between the growth of plants on virgin soil and that of plants grown on old cinchona land:

> ...the conclusion would seem to be that the change in the physical condition of the soil brought about by years of cultivation and exposure to sun and wash is the chief cause of the difficulty...A period of fallow, the application of manure, and the planting of shade trees appear to offer the best chance of success in the replanting of old land, and it is proposed to experiment on these lines.[641]

The seasons did not become anymore predictable as the century came to a close. The year 1899-1900 was described by Superintendent Standen as "altogether abnormal", both the south-west and north-east monsoons failing. "The average annual rainfall at Nedivattam for the preceding 20 years was 99.23 inches, but during the past season the amount registered was only 52.83 inches. This is the smallest total of rain that has ever been recorded on the Nedivattam estate."[642]

7.3.2 The Plantation Pests

Cultivation, and particularly cultivation in a new environment, introduced the cinchona to a whole new set of enemies. As Brockway puts it, "In a new environment selected and shaped by humans, the plant's natural enemies are left behind, and human attention tries to ward off new ones" (1983:31). Dodge expands on this to explain some of the specific hazards of the plantation system.

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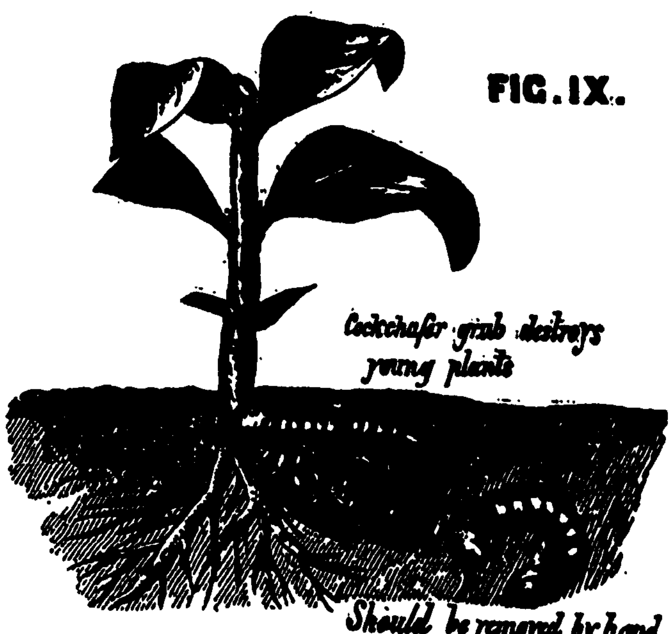
639 AAR, 1887-88:3. RBGK. MRMC.
640 AAR, 1895-96. RBGK. MRMC.
641 AAR, 1897-98:5. RBGK. MRMC.
642 AAR, 1899-1900:3. RBGK. MRMC.

> Plantation life, however, has brought new problems undreamed of by the early plant hunters. When a tree is moved from its nearly solitary state of scattered small groups among an almost infinite number of other trees into organized communities, it is introduced to the risks of community living. Insects which like to feast upon it settle happily near such plantations to grow fat and multiply. Infections, no longer quarantined by natural isolation, spread easily from tree to tree (Dodge, 1962:61).

Over the course of the experiment a number of unwelcome pests, from the microscopic to quite large, attacked the Nilgiri cinchona. "The European planters, whose prime concern was the economic health of their plantations, claimed that sambhur, spotted dear and other animals were mere pests destroying their plantations, especially young cinchona plants" (Pandian, 1995:256). Young plants were especially vulnerable to destruction by the grub of the cockchafer (figure 7.3) which had to be removed from the roots by hand, or could be wiped out if action was taken at the commencement of the first spring showers in March or April before problems arose, "Bright fires being lighted here and there on the land about half-past six in the evening, and a good flame maintained until about eight o'clock, myriads of these insects dash into the flame and are destroyed."[643]

Figure 7.3 - Illustration Depicting the Grub of the Cockchafer Attacking a Young Cinchona



Source: AAR 1864–1865. BPP, 1866:170.

[643] AAR, 1864–65. BPP, 1866:170.

The Nilgiri sambur or elk was the most prominent pest, "The giant of the corvine race – often fourteen hands high, with antlers upwards of three feet long, spanning thirty-two or thirty-three inches between the extremities" (Burton, 1851:220). In 1870, the sambur featured in the rapid decline of the government's remote Mailkoondah plantation. The Commissioner reported, "The superintendent's cottage has tumbled down; the few acres planted seemed to be eaten off by the sambur; I saw nothing but here and there a few chinchona-sticks without leaves..."[644] Elsewhere the red bark (*Cinchona succirubra*) continued to be the most luxuriant of the introduced species, precisely because it was less prone to damage from wild animals, the most common of which was the sambur.[645]

After being accused of employing coolies to slaughter game and keeping the heads, horns and skins as his perquisites in September 1877, overseer Rowson wrote to the editor of the *SIO*, where he explained that a coolie named Ram Singh was employed to shoot any monkeys and sambur which trespassed onto the government cinchona plantations at Pykara. "The animals do great damage to the Chinchonas by rubbing off the bark and eating the leaves and young shoots..."[646] Others subsequently questioned the amount of damage caused by the sambur,[647] worried about the depletion of game for sporting purposes, suggesting that planters were hunting in order to pay their workers in meat (Pandian, 1995).

In 1879, on his estate Deva Shola, Mr. Money applied for ownership of two pieces of forestland adjoining his property so that he could secure a supply of the jungle material to construct a fence to protect his property from the sambur's ravages. However, despite having the support of Mr. Barlow the Commissioner, Money's application was refused, apparently as a result of complaints by *Burghers*.[648]

The Nilgiri Game and Fish Preservation Act (the direct result of a campaign by the Nilgiris Game Association) was passed in 1879 with the aim of game conservancy.

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644 Commissioner of the Neilgherries to the Secretary to Government, Revenue Department, Madras, dated Ootacamund, 28th May 1870. BPP, 1877:3. This serious decline was in spite of the estate receiving the highest expenditure (562 rupees per acre) of all the estates, see Order of the Madras Government, dated 21st December 1870. BPP, 1877:12.
645 AAR, 1869-70. BPP, 1877:4-5.
646 BL. *SIO*. 29th August 1877. p.2.
647 BL. *SIO*. 1st September 1877. p.2.
648 BL. *SIO*. 1st February 1879. p.8, col. A.

Principally, it meant the introduction of a closed season during which the hunting of game was forbidden. Access to arms was to be restricted by license, and *shikaris* required to be registered. As Pandian explains, it "restricted legally sanctioned hunting to trophy-seeking, and marked out other forms of hunting [practiced largely by the indigenous 'other'], particularly utilitarian hunting aimed at protection of crops, procurement of meat and so on, as illicit" (Pandian, 1995:240), a first step in the emergence of conservation and environmentalism (MacKenzie, 1997). Hunting for the protection of crops in private lands was, however, outside the remit of the Act, and many planters employed native *shikaris* to guard their plantations from the sambhur, placing them "outside the colonial canons of sport" (Pandian, 1995:256).

In 1882 the local newspaper received more reports of problematic sambur from cinchona planters, "... one planter informed us that he had a thirty-acre field of flourishing plants eaten down to a disheartening extent."[649] Mr. Money had now succeeded in enclosing his Deva Shola Estate which the *SIO* named an example of good practice in the war against the sambur.

> The proprietor is wisely planting blue-gum just outside the fence, the plants being put down about a foot apart. The rapidity of the growth of the blue-gum which in this locality attains a height of five or six feet in a year, makes it quite reasonable to expect that before the decay of the posts that now hold the wires, a fine and impenetrable natural hedge of blue gum will have grown up, which with the wire transferred to live supports will completely frustrate the efforts of the enemy to get into the cinchona... We have heard it suggested that all the expense of wire fencing might be saved, if cinchona growers would take to keeping a few dogs of a proper breed, namely a cross between a fox hound and a grey hound...[650]

However, in 1885, the government plantations were still suffering attacks. Although great advances had been made in the restoration of the Hooker estate, Lawson characterised the situation at the Wood plantations as being, "increasingly miserable", attributing much of the blame to the "pestilent sambur",[651] the difficulty in keeping them out of the plantation "well nigh insurmountable."[652] A barbed wire fence imported from England at a cost of Rs 600 was to be erected, as shooting had

[649] BL. *SIO*. 23rd July 1881. p.7, col C.
[650] BL. *SIO*. 23rd July 1881. p.7, col C.
[651] AAR, 1884–85:3–4. RBGK. MRMC.
[652] BL. *SIO*. 7th November 1885. p.9, col. D.

proved ineffective in keeping numbers down. More was now beginning to be understood about their habits. "The sambur it appears are of migratory habit and there is a constant stream of them passing at one time of the year from the plains to the Hills, and at another time from the Hills to the plains. This explains why destroying them in a particular locality makes no difference in their numbers."[653]

Ten years later in July 1895, when Dr. King of the Calcutta Botanic Gardens visited and inspected the Nilgiri plantations (following up previous inspections he'd carried out in 1871 and 1878), he highlighted the ongoing destruction caused by both sambur and jungle sheep.[654]

> During my present visit I have questioned the Superintendents and some of the natives[655] resident on the various plantations, and I have seen for myself ample evidences of the evil... Fencing appears to afford little or no protection against this kind of game, and the only efficient way of protecting the young plantations and coppice is by shooting the deer.[656]

The employment of a single *shikari*[657] remained the preferred method of protection, charged with frightening the game off all the government plantations. However, the government had recently been faced with accusations that game in the neighbourhood of the cinchona plantations had been virtually exterminated as a result of the *shikari*'s actions, accusations King could not comprehend.

Insects also had the potential to invade the cinchona. By 1879 reports from the Bengal plantations suggested that mossing had not been successful owing to the presence of ants, which, "getting beneath the moss, eat the young bark as quickly as it is formed " (Anon, 1879:3). By and large the Nilgiri plantations were much more fortunate although in 1884 Lawson had to destroy a large quantity of the seed remaining on hand at the close of the year after he found it attacked by weevils and mould.[658] There were also several lucky escapes from insect invasion. On the 28th February 1878:

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653 BL. *SIO.* 7th November 1885. p.9, col. D.
654 Barking deer (*Muntiacus muntjak*).
655 King perhaps felt that the natives knew the habits of the Nilgiri game best, and respected their opinion on this topic.
656 AAR, 1895-1896:25.
657 See Pandian, 1995 for more on the relationship between *shikaris* and European game hunters.
658 AAR, 1883-84. RBGK. MRMC.

> ...an enormous flight of locusts passed through Neddiwuttum...They were travelling northwards, through the Ossington Cinchona and Prospect Tea Estates, in both of which they alighted. Their flight continued from 10AM till 2PM. At midday the host extended for some 10 miles in length, by 2 in breadth and some 30 feet in height. They were then so thick that they quite darkened the air and a cinchona tree was invisible at a distance of 30 feet. They alighted frequently but eat nothing...If they came hungry they might prove a frightful scourge, in destroying our cinchona, coffee, tea and the indigenous cereals. The natives consider their visit to be an evil augury, and to portend famine, pestilence or war.[659]

Back in London cockroaches were said to have destroyed some of the *Cinchona carthagena* plants gathered by Cross who reported that the insects "...very nearly gobbled the whole up before I was aware ..."[660] The authorities at Kew flatly denied the presence of cockroaches in their propagating houses:

> Mr. Hooper stated in his paper that after the arrival of the plants at Kew 'much difficulty was experienced in preserving the Magdalena plant, owing to the frost of the following winter and the cockroaches feeding upon it.' I am quite sure that there is no real foundation for this statement in as much as the propagating department at Kew which is filled with plants...from every part of the world is absolutely free from such pests...[661]

7.3.3 Disease

Disease had the potential to disrupt the cinchona experiment in two ways, striking the trees themselves and the labour force who worked the plantations. The cinchona was vulnerable to a number of diseases, but the Nilgiri trees largely escaped widespread harm from this particular menace. The broad term 'canker' was used to describe most disease which struck the plantations, although the Darjeeling plantations suffered much more extensively in this way, the authorities sometimes blaming the source of the canker at Darjeeling as the Nilgiri plants sent to form the original plantation stock.[662] McIvor refuted the accusations, and after a full investigation of the matter in 1873,[663] government concluded, "Mr. McIvor has shown that it is extremely improbable that canker existed in the plants in question when originally sent up from the Nilgiris, though it is possible that the disease may

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659 BL. *SIO.* 2nd March 1878. p.6, col. C.
660 Cross to the Under Secretary of State for India, dated London, 16th October 1878. RBGK. IEPC.
661 Thiselton Dyer to J.A. Godley, India Office, dated Kew, 29th October 1888. RBGK. IEPC.
662 Commissioner of the Nilgiris to the Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 13th December 1871. BPP, 1877:61.
663 See BPP, 1877:116-127, where the main players in the debate were all asked for their comments and evidence in support or otherwise of the accusations.

have been generated on the journey to Sikkim."[664] Shortly afterwards the *SIO* reported the appearance of a disease caused by an insect amongst the cinchona plants in Java, the same that caused the so-called rust among tea plants.[665]

The Nilgiri plantations though were believed to be among the healthiest in the world, although Howard revealed a note of caution in 1871 after close inspection and chemical analysis of two five year old trees grown in the Government Gardens.

> ...The occurrence on the lower part of the trunk of each tree of a peculiar white fungus occupying the crevices of the bark... penetrating into the very wood itself... I look upon this as a very bad indication; and, judging from the analogy of beech-trees similarly affected in plantations here, should regard it as an almost fatal sign... (Howard, 1871:362).

Cross later commented of this fungus that, "It would not astonish me to hear of it being seen more or less over all the plantations... the fact of allowing such an evil to get so far on is not nice."[666] However, it would seem that these were by and large isolated cases.

Private estates, being generally smaller in extent, were perhaps more vulnerable to disease, although mixed cropping acted as an insurance measure. In August of 1879, W.E. Mullay of Droog coffee estate, Coonoor, forwarded a specimen of a cinchona plant attacked by the black coffee bug (*Lecanium nigrum*), to the Nilgiri District Commissioner. Mullay had planted 7,000 cinchonas (purchased from the government plantation at Naduvattam in 1878) along the estate roads and in various parts of the estate:

> ...and in every instance wherever the coffee is attacked by the bug the Chinchona plants in the vicinity become attacked at one and the same time. I am within the mark when I say that of the 7,000 plants...quite five thousand of them are more or less attacked by the coffee bug; this is a very large percentage, and seems to point to the fact that this pest will take kindly to Chinchona.[667]

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[664] Acting Secretary to the Government of Madras, to the Secretary to the Government of India, dated Ootacamund, 2nd October 1873. BPP, 1877:127.
[665] BL. *SIO*. 26th September 26th 1877. p.5.
[666] Cross to Howard, dated Guayaquil, 24th October 1872. RBGK. JEH/1/16.
[667] BL. *SIO*. 29th October 1879 . p.8, col. A.

In November of the same year (1879) it was reported that the borer had appeared on two estates in Dimbula in Ceylon,[668] but once again the Nilgiri estates escaped. A report into cinchona mortality as a result from canker on private estates in the Wynaad during 1889-90, concluded that the disease was not due to any attack from parasite, but simply to the poverty or hardness of the soil.[669] In general, disease amongst the cinchonas was nothing like as devastating as that experienced on the coffee estates of Ceylon for example (see Duncan, 2007, Barron, 1987 and Webb, 2002).

Disease in laborers was more disruptive to the Nilgiri cinchona plantations. As was the case with labourers on the Assam tea plantations explored by Behal, "Because of the climate and unfamiliar food in the new country the immigrants were liable to serious sickness" (2010:43). As documented in section 7.1, much of the labour used to establish the government cinchona plantations came from convicts, transported to the Nilgiris for the duty and housed in specially constructed jails on the plantations. The health of this prison population is generally reported in a favourable light, with very few deaths registered in the official records. McIvor was however aware that when disease struck, prison living conditions could contribute to disease spread. In 1868 he explained that although the convicts had been working well for the plantations, their health at Naduvattam had not been as good as at Dodabetta, partly in consequence of two batches of the convicts arriving at an unfavourable season;

> ...many of these men suffered from the sudden change; dysentery, bronchitis, and chicken-pox broke out among them. Having at that time insufficient hospital accommodation, the diseases spread more than otherwise would have been the case. We have now erected a good hospital at some distance from the gaol, and it is anticipated that in our future reports, we will be able to show the health of the convicts at Neddivuttum much improved... and as the employment in which the men are engaged is very healthy... so soon as they become accustomed to the climate, there can be no doubt the health of the prisoners in this gaol will shortly equal Dodabetta.[670]

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[668] BL. *SIO.* 8th November 1879. p.5, col. C.
[669] AAR, 1889-90. RBGK. MRMC.
[670] AAR, 1867-68. BPP, 1870:179.

Although the Nilgiri climate was believed to be amongst the healthiest in India, with the region escaping the worst of the suffering associated with the 1877 famine, drought conditions did lead to an general increase in the incidence of disease. The *SIO* reported: "The long spell of dry weather we are having – the sultry days and frostly nights – have all contributed to render the place somewhat unhealthy. Fever, small-pox, chicken-pox, and dysentery are prevailing to a great extent."[671] As the dry weather continued in August rumours circulated that some planters were rejecting coolies brought to their estates under contract because they were unfit for work, a practice which the *SIO* warned against, explaining that because the men "are not able bodied and immediately fit for heavy work... planters... can afford to be select in the choice of their work people, but the heartless proceeding of turning away hands specially engaged... can hardly prove true economy in the end."[672]

Labour shortages became once more apparent the following year. Although sufficient at the beginning of the year, "...sickness breaking out a large number died and others left through fear. During the wet months the roads to the Naduvattam and Pykara Plantations became impassable for cart-traffic, so that grain could not be got out for supply to the labourers employed in those estates..."[673] The erection of a Ragi store[674] at Naduvattam and the storage of large supplies of grain were thought likely to remedy the situation a little.

When the manufacture of sulphate of quinine was almost ready to begin in 1889, an outbreak of Russian influenza severely delayed production as:

> ...every one of the workmen, who had been educated with so much care during the former months, being scared by the reports, which they had heard respecting the disease, fled to their homes in Mysore, and up to the present time not one of them has returned. Fresh men had, therefore, to be drilled, and it was only towards the middle of May that it became possible to recommence work on anything like a proper scale.[675]

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671 BL. *SIO*. 17th January 1877. p.4.
672 BL. *SIO*. 8th August 8th 1877. p.5.
673 Revenue Reports. Barlow (Commissioner) to Master (Secretary to Government), dated 5th October 1878:4. RBGK. MRMC, 1861-85.
674 Ragi or finger millet is a cereal grown in Africa and Asia, and is very adaptable to the highlands of India. It is often ground to make ragi flour and cooked to make cakes, puddings or porridge.
675 AAR, 1889-90:4. RBGK. MRMC.

Ironically this outbreak of influenza served to increase the demand for quinine as at the time it was supposed to be malarial in nature.

The plantation cattle were struck down by disease at a similar time, an outbreak of rinderpest[676] at Naduvattam resulting in the loss of 21 animals.[677] In 1897, the climate was once more conducive to the spread of disease, Standen recounted, "The dry season [December to March] was one of the hottest and driest on record [a record which now went back around 35 years], the cattle suffered considerably from want of sufficient pasture, and there was an unusual amount of sickness among the coolies."[678] Around 122,580 plants also died during the year.

7.4 Conclusion

There were many elements to manage on the Nilgiri cinchona plantation; labour, the plant, the weather, pests and disease. All of these presented challenges to both the government and private cinchona planter. Although supposedly located in a country where labour was plentiful, shortages presented significant problems, labourers reluctant to move to the cold hills and to the remote cinchona plantations. The tasks of the cinchona year were timed in accordance with the arrival of the monsoons, but shifted dramatically as the plantations became established and the plants reached an age where the bark could be harvested. Bad weather hit the cinchonas hard on several occasions; frost, fire and high wind were all able to wipe out huge numbers of young trees in a single night.

The sambur was the bugbear of government and private planter alike for the duration of the experiment, but the Nilgiri plantations largely avoided attack by insect or disease. Plantation labourers were not so fortunate, their living and working conditions being conducive to the spread of disease,[679] with rumours of epidemics enough to prompt large-scale desertion of the plantations. It is also likely

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676 Also known as cattle plague, rinderpest is an infectious viral disease mainly affecting cattle and water buffalo.

677 AAR, 1888-89. RBGK. MRMC. "In 1889, cattle shipped from India carried the rinderpest virus to Africa, causing an epidemic that established the virus on the continent. Initially, approximately 90% of the cattle in sub-Saharan Africa and many sheep and goats died. Wild buffalo, giraffe and wildebeest populations were decimated" (Center for Food Security and Public Health, 2008:1).

678 AAR, 1897-98:3. RBGK. MRMC.

679 Plague hit the plantations at Naduvattam and the Hooker site at Pykara in 1903-4, but was apparently checked by the prompt measures taken for segregation, coolie lines thoroughly disinfected. AAR, 1903-04. BL. IOR/V/24/564.

that a certain degree of brutality in manager's actions toward labourers was overlooked or even practiced by government.[680]

[680] See Behal, 2010, on exploitative labour relations on the Assam tea plantations.

8 Conclusion

Philip argues that, "The history of cinchona plants in the nineteenth century - their classification, collection, transplantation, cultivation, and commodification - is interwoven with the central issues of colonial science studies, environmental history, agricultural economics, and local knowledge" (1999:120). Whilst the role of cinchona and quinine in the expansion of the British Empire should not be exaggerated, the establishment and operation of cinchona plantations on the Nilgiri Hills of Southern India has not previously been given the recognition it deserves in histories of malaria and quinine, colonial plantation agriculture or the Nilgiri region. This thesis has critically examined the engagement and connections between government officials, planters, venture capitalists, labourers, plant material and ideas in the context of the cinchona plantations through a thorough study of archival and secondary sources. The resulting historical geography of the Nilgiri cinchona plantations contributes to a number of active debates within the 'new imperial history', humanitarian, financial and environmental.

8.1 Commodities of Empire

This thesis adds a new perspective to a growing literature regarding the commodities of empire and imperial botany. Together with botanical science (and the institutions in which they were housed), a number of plants are now widely believed to have been crucial aids to colonialism (Brockway, 1979, Drayton, 2000 Musgrave and Musgrave, 2000, etc). The category of 'commodities of empire' thus covers an array of plant-based trade goods, from the beverage crops of tea, coffee and cocoa, the luxuries of sugar and spices, to rubber and natural textiles like cotton and jute, dyes like indigo, and plant drugs including tobacco, opium and quinine. Although there are a number of published works which reflect upon the global development of quinine and cinchona within a wider world history of malaria, including two popular social histories (Honigsbaum, 2002 and Rocco, 2004), the story of the nineteenth century British cinchona experiment (unlike its Dutch counterpart, see Taylor, 1945) has escaped detailed investigation.

This thesis has explored work on the imperial history of quinine and cinchona (see Brockway, 1979, Headrick, 1981, Philip, 1995) and provided it with a specific geography, through a focus on specific sites of production, rather than those spaces of exploration that are so often emphasized owing to their high action adventurous nature and ever-present danger. The places of physical cinchona production and quinine manufacture and the associated generation of knowledge have been identified and explored, reinvigorating the way plantation agriculture is studied, through emphasizing the role of place (the specific contribution of the Nilgiri Hills is discussed below) and networks in the operation of plantations. The experiment operated in spaces on a continuum of scales, from the micro-spaces of the Ward's case and the greenhouse, to the plantation, laboratory and factory, international market, and global correspondence network.

In the second half of the nineteenth century, cinchona became a tropical plantation crop. This study allows comparisons and parallels to be drawn between the management and operational strategies of the South Indian cinchona estates and those cultivating tea or coffee or other crops, particular in regard to studies of labour (for example see Behal, 2010 on the labour system in the Assam tea estates, and Ramasamy, 1992 on labour control and resistance on the Malayan rubber plantations). The Nilgiri cinchona plantations remained a largely unattractive option to labourers throughout the duration of the experiment owing primarily to their remote geographical locations and cool climate. The Madras Cinchona Department experimented with a range of solutions to resolve the problem of labour shortages on the hills, from importing labourers from the plains, convicts from the Straits Settlements, and recruiting indigenous hill tribes who lived on the Nilgiris. The identification and utilization of a number of distinct labour pools helped to reduce risk and keep the plantations working. Tasks were also amended to cope with labour shortages. Private planters were more restricted in their ability to attract labourers and their recruiters who had a rapidly growing number of estates to choose from. However the AARs frequently make mention to the fact that the government estates lost labourers (both skilled and unskilled) to private ventures who, presumably less restricted by pre-determined budgets, were able to offer a better daily rate of pay, and improved living conditions and belongings needed for the hill climate (i.e. blankets). Private individuals offering better wages also poached trained and supervisory workers.

The research also contributes to a relatively small scholarship on the role of science in plantation agriculture (see Barron, 1987 on the scientific strategies of coffee planters in Ceylon, or Kumar, 2007 on plantation science on the Indian indigo estates), emphasizing the importance both government and private ventures attributed to determining definitive cinchona science. Although 'official' and 'authoritative' cinchona science was, in the main, formulated on the government plantations and then disseminated out to the private estates, at various times during the course of the experiment, a small core of well-respected and influential private planters took it upon themselves to co-ordinate experiments in cultivation and harvesting.

Recent attempts to situate science and knowledge production have largely neglected the plantation as a site of science, instead favouring the laboratory (Shapin, 1988), field, museum and lecture hall (Naylor, 2002). Although the importance of the garden in creating and shaping science has now also been recognized (see Livingstone, 2003), the formulation of agricultural science is worthy of further attention, especially given its importance to empire. In the cinchona experiment it was paramount that the plantation and laboratory worked together to formulate science, disagreements between the individuals given charge of these spaces acting both to disrupt and progress cinchona science.

Although government-owned plantations had also been established to popularize the cultivation of tea in India, with cinchona the government plantations were to remain the largest and longest-surviving ventures, with privately owned acreages remaining low (in comparison to those of tea and coffee) throughout the experiment's duration. It is for this reason that the role of private plantations in the cultivation of cinchona has previously been overlooked. The interesting relationship between the public and privately owned plantations is another important contribution of this research to the study of imperial commodities. Although government actively encouraged private plantations, little financial support was provided in a cultivation that required a considerable initial outlay of capital and took around eight years to see any profit. The government's actions in the market were also viewed by some to be to the detriment of the profits of private estates, especially in the face of increasing competition from elsewhere.

On a number of occasions the government was also seen to be demonstrating a less than exemplary example of how to cultivate cinchona, the plantations falling into a state of neglect after the death of the first Superintendent William McIvor, leaving private planters with very little guidance in an unproven and largely untested cultivation. The distinction between public and private ownership of cinchona estates is complicated by the fact that a number of those employed in the official government project also invested in private ventures. This was a practice officially condemned by government, who feared it led to the neglect of the state plantations. The tensions between preserving forest cover and the clearance of forested land for plantations (cinchona and otherwise), and more widely the tensions between state-led scientific forestry (see Barton, 2001) and cinchona cultivation, also become apparent, both activities believed to be essential to maintaining the health of Europeans in the tropics (in the former case through the preservation of a favourable climate).[681]

8.2 Acclimatization and Tropicality

Whilst a global network of plants, people and knowledge always remains in view, providing the study with a very specific local geography (its centre at Ootacamund) has enabled an exploration of the interplay between the natural environment, people and the imperial project, contributing to scholarship on the acclimatization of both plant and people. This acclimatization project, like so many others, was "entwined with the rise of modern imperialism" (Osborne, 2001:135), with reports of success serving as symbols of and propaganda for European superiority and power over distant lands and over nature itself.[682]

Previous research on the Indian hills has outlined their role in the development of theories concerning the tropics (particularly regarding their healthiness relative to the plains), and in the political and social geography of empire (see Kennedy, 1996, Kenny, 1991, 1997, and Pradhan, 2007). The conceptualization of the Nilgiri climate as 'healthy' was a key development in the founding of a British settlement at Ootacamund, the presence of which was in turn influential in the selection as the site for the initial cinchona plantations. Support also came from the previous successes in plant acclimatization achieved by the early residents of the town, and McIvor and his team at the Government Gardens.

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681 Also see Sutton, 2009 for more on these tensions.
682 See MacKenzie, 1986 for more on propaganda and empire, particularly the role of international exhibitions.

As sites of scientific research, the Indian hills have, however, been largely ignored. Indeed even in much literature on the Nilgiris' environmental and plantation history (see for example, Heidemann, 1997, Muthiah, 1996, and Tanna, 1970), cinchona is largely absent from the story, hidden by the dominant acreages of first coffee and then tea. Yet at its height the cinchona acclimatization experiment was the talk of the Nilgiris, with the hill climate of great importance in its facilitation; apparently perfectly suited both to the growth of the South American tree and the mind and body of the European planter. This was a place where planters were willing to experiment with science, perhaps more than they were 'at home'. Cinchona plantations then, worked in collaboration with the phenomenon known as the hill station to secure the safety of Europeans in India. The research thus builds on other attempts to recognize the importance of the Nilgiris in British imperial histories (Cederlorf, 2002, Kenny, 1995, Morrison, 2004, and Sutton, 2009).

However, the Nilgiri's environment and ecology conversely left the plantation vulnerable, holding the power to uproot mature trees, leave acres of valuable crop as nibbled sticks, and strike down plantations, and their labourers, with disease. The tree itself acclimatized relatively well to its new home, (once a batch reached the Government Gardens in a relatively healthy state), and McIvor quickly learnt about the conditions they required. Few natural enemies emerged, barring the annoying sambur. However, confusion reigned over the classification of different varieties for the entirety of the experiment, and to an extent continues today (see Andersson, 1998), awarding power to the cinchona itself to disrupt the smooth course of the project. Even if growing apparently luxuriantly, it was only once the dried bark entered the laboratory that its value could be determined. On more than one occasion the cinchona trees fooled expert botanists as to their true alkaloidal worth. The complexity of the genus added further intricacies to the cultivation, alongside the investment of time and resources required before there was any hope of a financial return.

As Sutton explains, "Any bridging between the study of a region like the Nilgiris and the broader agrarian historiography of South Asia must be tempered by a consideration of the deliberate and cultivated exceptionalism of the hills" (2009:5). It was this 'exceptionalism' that led to the Nilgiris becoming the first site for cinchona plantations in the British Empire, and which contributed to the enthusiasm for the new cultivation. Ootacamund was already well-connected in an imperial network of exchange, and a popular retreat and congregation point with those like the Denison family and James Money who held power, influence and capital, and connections to government and botanical institutions within the British and other European Empires. The aim has not been to take anything away from established centres of imperial calculation (Latour, 1987) like the RBGK and the RGS, but instead to highlight the contributions and place of other nodes like Ootacamund, in facilitating the imperial botanical network (see below). Ootacamund became the administrative and operational centre for the wider experiment, providing plants, seeds and expertise for other cinchona sites.[683] Place was important in the production of knowledge on the cinchona tree and Ootacamund's established place in the network of imperial power (as holiday retreat, home and later summer capital), allowed the mechanisms of the experiment to work, and defined the knowledge emanating from it as authoritative.

8.3 Tropical Medicine

As the source of a drug which became viewed as increasingly essential to the safety of Europeans in the tropics, and accordingly for the expansion of empires, cinchona is somewhat unique as a plantation crop. Its history forges links between tropical environments, plantation agriculture, medicine and disease. Owing to the nature of the end product of the plantation and factory being an article of medicine rather than food or beverage luxury, those involved in the cultivation of cinchona can be viewed as being actively engaged in the improvement of the health of the citizens of the British Empire, and ultimately the survival of the Empire itself, as well as (in theory at least) making themselves a tidy profit. Cinchona was seen by many to be of central importance to the prosperity of the British Empire.

The experiment's most valuable contribution to medicine came from the results of medical trials and analysis undertaken in the most feverish districts of India, which revealed that the cinchona alkaloids other than quinine (particularly cinchonidine) were just as effective as quinine in the treatment of fevers. Problems in popularizing

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683 The archives of the Nilgiri Collectorate in Ootacamund are likely to hold plans and other information relating to private cinchona plantations, certainly those plots of land obtained under the Wasteland Rules (see Sutton, 2009). If access could be negotiated, these would add further detail to the study of the spaces of cinchona science.

their use were not so easily overcome, particularly in the European market. However, within India, the other alkaloids, often in 'febrifuge' blends became widely used by planters won over by the cheaper price tag, who administered it to their labourers in attempts to keep them productive. The availability of government-produced febrifuge was frequently advertised to the Nilgiri planters in the *SIO*. The development of this European medicine was no "accident of empire" (Macleod and Lewis, 1988:*x*), yet has been completely overwhelmed by quinine when it comes to academic scholarship. Much more also remains to be done on the bark market, quinine manufacturers and druggists (a particularly rich archive exists for the Howard and Sons Company), and the production and application of quinine tonics.

It would also seem reasonable to assume that labourers on the plantations would have been influenced in some way by the dominance of cinchona in their lives, their perspectives on quinine or western medicines more generally perhaps altered. They would also have been made starkly aware of the distinction between drugs intended for European and Indian consumption, reinforcing established power structures. However, when encouraged to take up the cultivation of the cinchona tree on a small scale in order to produce a supply of bark to protect from fever, Indians living in the vicinity of the Nilgiris remained generally uninterested in a cultivar that Europeans were obsessed with. The government Quinologists did however conduct limited investigations and analysis into Indian remedies for fever.

8.4 Geographies and Networks of Cinchona

Said (1994) contends that colonialism is first and foremost a struggle over geography. Geography was always at the forefront of the British cinchona experiment; whether through guiding the exploration of the South American cinchona forests, the identification of suitable climates for the cinchona in the colonies, selecting plantation sites, sourcing a suitable labour force, the geographical distribution of pests or disease, the global network of exchange, the involvement of geographers in the project, and ultimately the geography of its archive. Networks of exchange created the documents and artifacts that have allowed this story to be told, and defined the methodology employed.

The methodology and resulting historical geography contributes to recent work on the geography of biography (Daniels and Nash, 2004) and the employment of narrative geographies[684] to move away from "a dry chronicle of ideas to create a history richer in personalities, actions and an understanding of the differences that space and place make" (Lorimer and Spedding, 2005:15). People are central to the story of this commodity (see appendix B). The lived experiences of those involved in the experiment enrich the history, and expand literature on plant hunters and the Directors of botanic gardens, to include the contributions of people who took up other roles, whether professional or amateur. The professional and friendship networks and the role of institutions like the RBGK and the RGS in the cultivation also make cinchona somewhat unusual. However, there are a number of missing narratives from this story. If the papers of the McIvor family could be traced, for instance, a real insight into the fascinating original Superintendent might be found, and would tell us more about the family networks in operation on the Nilgiris which operated across government and private interests.

Personal experience of the hill climate and landscape, although much changed since the early years of cinchona, enabled an understanding of the fascination the Nilgiris held in the European imagination during the latter half of the nineteenth century, and the geography and topography of the plantations. The years of cinchona are still thought of fondly among labourers on the tea estates.

As Lester explains, "From the beginnings of British imperial history writing at the end of the nineteenth century, the differences between spaces and places, particularly 'metropolitan' or 'core' ones, and 'colonial' or 'peripheral' ones, have been absolutely fundamental to our imagination of the British Empire" (2006:124). In his account of 'imperial circuits and networks', Lester goes on to interrogate these spatial concepts, also providing an account of the development of the 'new imperial history', turns toward the metropole (in the form of 'gentlemanly capitalism') and then back to the periphery, to a renewed focus on integration and interaction, and the more recent recognition of the existence of a multiplicity of metropoles and peripheries. There is no doubt that the driving force for the cinchona project was located in Britain, and more specifically concentrated in

684 For example the 'Narrating landscape and environment' session organised by Stephen Daniels and Hayden Lorrimer, and sponsored by the AHRC, at the RGS-IBG Annual Conference held in Manchester, August 2009.

London, and that through their membership of institutions like the RGS and other gentlemen's clubs, figures like Sir Clements Markham could be characterized as 'gentlemanly capitalists'. But the experiment depended on more than this, not least a suitable environment and skilled labour force, and the operation of more informal networks.

Although the archival sources primarily highlight the interactions (largely through written correspondence) between London and Ootacamund, it is important that there is an awareness that these were components of, "much more extensive networks connecting multiple colonial and metropolitan sites, and that these networks were built and reformulated by colonial interests in tension with one another as well as with indigenous peoples" (Lester, 2006:133). Ootacamund occupied a 'nodal' point, or meeting point of trajectories (Lester, 2006) in the global cinchona network that also relied upon global networks of imperial power, capital and leisure tourism.[685] The experiment was essentially an exertion of power but one that also demonstrated the very vulnerable nature of the empire. The hill stations and the cinchona plantations, found their reason for being in nineteenth century fears of the tropics. Like Jennings' history of the French colonial spas then, the history of the Nilgiri cinchona plantations is partly, "a history of colonial anxieties and countermeasures" (2006:2).

[685] Complementary work could also be completed for the plantations in the Bengal Presidency, or on the islands of Ceylon or Jamaica, mapping more of the cinchona network's 'nodal' points.

Appendix A - The Nilgiri Cinchona Plantations: An Afterword

When the *Visitors Handbook* to the Nilgiri region was produced in 1905, the government cinchona plantations were said to cover an area of approximately 900 acres. A further 900 acres were cultivated by private planters (on 147 estates) who sold their bark (estimated at 650,000 lbs) to the government factory which turned out, "enough of the drug for distribution to the various Indian Medical Departments and for sale to the natives in pice packets, calculated to cheapen and popularize it as a febrifuge" (Anon, 1905:8). Of the bark imported into India in the year 1912-13, 77,509 lb came from the British Empire and only 27,475 lbs from foreign countries (Imperial Institute, 1918:379). A 'manufacturing chemist' Mr. Richardson, was appointed to the Nilgiri factory in 1912, but died in 1915, along with the then Superintendent Mr. Ryan.[686]

In that year the Government of India made the decision to hold a permanent stock of around 250,000 pounds of quinine in order to manage possible malaria epidemics and to protect against any possible rise in world price in the future. However reserves soon fell short of military requirements during the war years, leading to a resurgence of interest in the Nilgiri plantations. A survey commissioned by the Imperial Institute revealed that figures for the area under cultivation and in the quantity of bark raised showed, on the whole, an upward tendency in private plantations, declaring that, "It seems clear that there is room for a considerable increase in the production of cinchona bark and in the manufacture of quinine in India to meet home requirements, and to maintain even the present modest exports of bark" (Imperial Institute, 1918:375). The figures for quinine manufacture on the Nilgiris failed to give a complete picture, "...as in certain years the authorities prefer to import bark [from Java] for quinine manufacture to utilizing the local crop..." (Imperial Institute, 1918:374). In 1919, the government entered into a contract with Howard and Sons that lasted until 1928, and between 1921 and 1923 with the Dutch Combine (Muraleedharan, 2000).

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[686] AAR, 1915-16. BL. IOR/V/24/564.

In 1919 Lieutenant Colonel A.T. Gage (then Director of the Botanical Survey of India) was asked to report on the possibility of extending Indian production of cinchona, amid rumours of the creation of a single Imperial Cinchona Department.[687] He chose a site known as the Tavoy-Mergui tract in Burma as easily offering the best opportunity for extension, recommending that the cultivation should be carried out by Government, and that the present cinchona departments (Madras and Bengal) should be amalgamated (see Muraleedharan, 2000).[688] The plantations recommended by Gage were opened up in 1920, but were washed away by heavy rains in 1921-22. Replacements elsewhere were opened in 1923 but due to labour shortages and a restrictive climate, they only had limited success. The two departments also remained separate (Muraleedharan, 2000). In 1920 the Madras Cinchona Department became disassociated from the pice packet system of quinine distribution, and the jail at Madras agreed to be a better distribution centre. This decision was made thirty years after the inauguration of the system, when, "countless millions of packets have been disposed of, at a popular price, thus bringing the only established cure for malaria within the reach of the poorest classes."[689] For the previous twenty years large purchases of bark had been made from private growers to supply the factory, with government bark reserved for emergency use, the factory worked day and night during the First World War.[690]

The 1924 UPASI directory compiled by Waddington listed the government cinchona estates of Dodabetta and Naduvattam, and a single private estate as the only plantations on the Nilgiris still cultivating the tree, together totaling 1,626 acres, compared to 10,645 acres of tea, 7,556 of coffee and 114 of rubber. Extensions in the cultivation were recommended at the quinine conference in Delhi held in December 1925, and planting in the nearby Anamalais Hills begun in 1926, but were checked by a large fire in March of 1939.[691] A 1929 survey by Dr J.M. Cowan of the Indian Forest Service and Officiating Director of the Botanical Survey of India highlighted the fact that Java now supplied nine-tenths of the world's supply of bark (Cowan, 1929), and *The Lancet* had little doubt that, "a coordinated, Empire-

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687 AAR, 1919-20. BL. IOR/V/24/564.
688 Also see Gage, 1918.
689 AAR, 1920-21. BL. IOR/V/24/564.
690 AAR, 1921-22. BL. IOR/V/24/564.
691 See AAR, 1925-26. BL. IOR/V/24/564, and AAR, 1939-40. BL. IOR/V/24/565.

wide scheme for the planting of cinchona and the harvesting of its alkaloids is not merely forced on us by considerations for the Empire's tropical inhabitants, but will repay the cost many times over" (Anon, 1929a), echoing exactly Markham's sentiment of 1859. *Nature* also urged the importance self-sufficiency in bark for India (Anon, 1929b). By 1937 cinchona covered just 1,028 acres of the Nilgiris.

Sulphate of quinine continued to be sold at Post Offices into the 1930s, the cinchona industry still representing one of the largest government controlled industries in India at this time (Anon, 1930c). The revenue achieved from these packets now far outweighed that from exports of raw bark,

> In 1927-28 quinine sulphate alone sold to Government offices and Institutions as well as to the public amounted to Rs. 3,92,049-8-0, while the total sale for quinine sulphate, cinchona febrifuge and allied salts amounted to Rs. 5,38,202-5-9... in 1922-23 nearly all the bark from private estates was taken over by the Madras Government for quinine extraction at Neduvattam during which year the exports fell to 16,090 lbs valued at £552 only (Anon, 1930c:614).

In 1939 and the outbreak of a second World War, attempts to reestablish private interest in cinchona included the resumption of the sale of seed from the Government Gardens at Ootacamund, alongside the publication of a pamphlet titled 'Cinchona cultivation in Southern India'.[692] When Evans reported on the possibilities of extending cinchona cultivation in 1941 he concluded,

> In India the present position is that the possibility of extension in Bengal is very limited, whilst in Madras new areas are being tried out in the Anamalais, and a recent report by Wilson and Mirchandani indicated that enough first-class land existed for an early resumption of cinchona growing, about 38,000 acres of first class land being available in Bengal, Assam, Orissa, Bhutan, Sikhim, Madras, Mysore, and Coorg (1941:119-120).

The production of cinchona by private planters had now practically ceased, the government having refused repeated calls for a guaranteed minimum price. This was in spite of the fact that vast areas of the British Empire were still subject to the scourge of malaria.

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692 AAR, 1939-40. BL. IOR/V/24/565.

> It has been estimated that there are some 800 million people in the world to-day who suffer from malaria and that there are 2 million fatal cases annually. A large proportion of these casualties are British subjects. For example, the League of Nations Health Organisation gives data showing that 100 million people in British India alone suffer from malaria, but only 8 to 10 million are treated annually, and in other tropical parts of the Empire conditions are much the same (Evans, 1941:111).

Just before World War II, Java supplied over 90% of the world's consumption of quinine. Although the Dutch cinchona planter led a "precarious existence after 1890... because of the very high quinine content and the excellent technical support from the government Cinchona estates, it was possible for planters [in Java] to eek out a living until the end of Dutch colonialism in 1942" (Goss, 2004:115).

When the Japanese cut-off this supply through the occupation of Java in 1942, the impetus needed for the development of several synthetic antimalarials (chloroquine, atrabine, quinacrine, and primacrine),[693] existed and triumphed. Cultivation of cinchona was also undertaken in several countries in Central and South America (where it originally occurred),[694] and alkaloid production from these trees during the early months of World War II was a "deciding factor in preventing further advances by the Japanese in the Pacific area" (Tyler *et al*, 1988:204). These new plantings also involved a comprehensive survey of the cinchona species growing in South America (particularly those in Colombia and Ecuador), which is well described by Steere, 1945 and Hodge, 1944. The sampling work undertaken in these American cinchona missions provided the material needed for a new revision of the genus (see Andersson, 1998:3).

The picture in the 1950s remained that, "The preparation of synthetic quinine is a complicated and expensive process, and it is very doubtful whether it can ever replace the naturally produced drug" (London Cinchona Bureau, 1951:6). Like quinine, many of its synthetic versions have now also been affected by new resistance of the malaria parasite. From the 1980s a new class of anti-malarials known as the artemisinin-derived compounds have been isolated, extracted and developed from the Chinese medicinal plant, *Artemisia annua* or sweet wormwood.

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[693] In 1944 quinine was synthesized by Woodward and Doering at Harvard University.
[694] See maps: 'Northwest South America. Cinchona producing areas, provision edition'. Department of State Service Office, 1947, and 'Caribbean America. Cinchona distribution'. Board of Economic Welfare, 1946. BL. Maps 83001. (38.) and 78213. (3.) respectively.

Artemisinin combination therapies now have wide application and are recommended over single drugs because they help to prevent the development of resistant parasites.[695] The natural quinine alkaloid however remains useful in some serious forms of malaria and, "has potential as a cheap and at least partly effective treatment in areas where no other treatment is available" (Kew Economic botany website).[696]

Today, quinine's most frequent medical use is in the treatment of cramps, but production is now centred on the food and drink industry where, "A considerable amount of cinchona bark enters into the manufacture of vermouth and certain bitter liqueurs" (Tyler *et al,* 1988:205), as well as continuing to be used in the preparation of effervescent tonic water (Meyer *et al.*, 2004). "It is thought that 300 to 500 metric tons of quinine are extracted annually from 5,000 to 10,000 metric tons of bark" (Starr *et al.*, 2003:1). Most cinchona is now grown in Africa (Zaire, Burundi, Cameroon and Kenya), although the government plantations in the former Bengal Presidency remain, spread over 26,000 acres in Mungpoo and Latpanchar, Munsong and Rongo. Although running at a loss, they employ around 6,000 people.[697] The tree has now acclimatized so well in some parts of the world that it has become a problematic invasive species in the Galapagos and Hawaii (Starr *et al.*, 2003).

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695 See: http://www.artemisininproject.org/Artemisinin [Accessed 16/02/10]. The illegal trade in ACTs in Uganda is the subject of Mark Honigsbaum's recent film 'The Killing Season' (2009).

696 http://www.kew.org/collections/ecbot/collections/topic/cinchona/a-short-history-of-cinchona/index.html [Accessed 16/01/2010].

697 In an attempt to make the plantations profitable, medicinal plants (dioscorea, ipecac) and cash crops (rubber, ginger and oranges) have recently been added to the productions on the Himalayan cinchona plantations. See: Anon, 2009a and 2009b), available at: http://beacononline.wordpress.com/2009/01/29/darjeeling-hills-orange-on-cinchona-plot/ [Accessed on 16/01/10].

Appendix B - Character Biographies

The cinchona story is one full of personalities. Below are short biographies of the main characters that appear, which focus on bibliographical details (where available) and their main contributions to the cinchona experiment, including positions of authority held and key publications.

Names in **bold** have separate biographies listed.

In alphabetical order;

Anderson, Thomas (1832-1870)

Born and died in Edinburgh. Anderson qualified as a Doctor of Medicine at Edinburgh in 1853 and entered the Bengal Medical Service the following year. He became Superintendent of the Calcutta Botanic Garden in 1861, holding the post until 1868. In 1862 he was given the additional charge of Superintendent of Cinchona Plantations in Bengal. In February 1861 Anderson travelled to Java to collect plants and seeds of *Cinchona calisaya* for the cinchona plantations in the Nilgiris. He was critical of **McIvor**'s methods, and was of the opinion that the Nilgiri plants were inferior to those raised in Java.[698] In March 1862 he travelled to Darjeeling and began the cultivation of cinchona in the Sikkim Himalaya, where later in the same year he was responsible for 2,000 plants. Later he probably played a part in the cultivation of rubber in India. Anderson's early death may have been as a result of malaria contracted during his work on cinchona. "Exposure in the feverish regions of the outer Himalaya, together with almost daily subjection, for weeks on end, to the sudden changes of temperature incident on passing from the cold climate of Darjeeling where he lived, to the hot steamy valleys of the Cinchona reserve, then a houseless waste, laid the seeds of disease of the liver which caused the premature death during 1870 of this able and zealous servant of Government" (King, 1876: 23). On his death, it was reported how, "He managed the first cinchona plantations, but the results were disappointing and his Reports tell how, step by step, success was won. He was often on horseback for ten or twelve hours in the

[698] Letter from Anderson to H. Bell, Under Secretary to the Government of Bengal, dated 6th August 1862. BPP, 1863:261.

day, going from warm tropical valleys up to Darjeeling, which he would reach chilled and exhausted."[699]

Arbuthnot & Co

Arbuthnot & Co was the biggest agency house (bank) in the Madras Presidency throughout much of the study period, until it collapsed in 1906. Begun in 1800 when George Arbuthnot arrived in Madras and joined Francis Latour & Co, in 1821 the firm became Arbuthnot & Co, with sixteen Arbuthnots related to the founder being associated with the firm before it collapsed. "The firm invested lavishly in daring enterprises, such as searching for gold in the Nilgiris and Anamalais, investing in American railway projects and new South African goldfields, and in the plantation crops of the West Indies, amongst other ventures."[700] Another branch of the family distinguished itself in the military and civil services and included a Governor of Madras and a commander of the Madras Army.

Batcock, G (*c.* 1838-?)

Trained at Kew, and selected by **William Hooker** to become **McIvor**'s deputy in both the gardens and Cinchona plantations[701] in 1861/62, described by a fellow 'Kewite' as "such a nice fellow" (Anon, 1894:15).[702]

Bidie, Surgeon-General George (1830-1913)

Born in Scotland and educated at Edinburgh and Aberdeen, Bidie entered the Indian Medical Service as an Assistant Surgeon in 1856, becoming Surgeon in 1868, Surgeon Major in 1873, Brigade Surgeon in 1883, Deputy Surgeon General in 1884, and Surgeon-General in 1886, retiring in 1890, having being made a Commander of the Indian Empire in 1883. He was appointed Honorary Surgeon to the Queen in 1898 and occupied the same post for King Edward VII and King

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699 Quote from *Curtis's Botanical Magazine*, reproduced on http://www.kew.org/collections/ecbot/collections/topic/cinchona/collectors-and-donors/index.html [Accessed 16/01/10].
700 http://www.arbuthnot.org/crash_of_arbuthnot.htm [Accessed 16/01/10].
701 Order of the Madras Government, dated 7th September 1861. BPP, 1863:183.
702 Reminisces of Mr Gustav Mann who, upon arrival at Kew from Paris, shared his bedroom in the gardens with George Batcock.

George V. In 1867-68 he was placed on special duty in the coffee districts of Mysore and Coorg, reporting on the ravages of the borer insect on the coffee plants. From 1870 to 1872 he was Secretary to the Surgeon-General and again held the post from 1880-1885. From 1872-1884 he was Superintendent of the Madras Museum, and served on the Cinchona Commission in 1873 (visiting the Government plantations on the Nilgiris, particularly investigating the relative merits of the mossing and coppicing systems),[703] becoming a Fellow of Madras University in 1879, and Sanitary Commissioner of the Madras Presidency in 1885. Upon retirement he acted as delegate from Madras at the International Congress on Hygiene and Demography in 1891. "He was the author of numerous works, chiefly on natural history, economic products, and coinage, all subjects connected with his work as Superintendent of the Museum."[704] Amongst his publications was *Cinchona Cultivation in India* (1878).

Biermann, Adolph (x-1879/80)

A companion of **Sir George King** and Curator of the Calcutta Botanical Garden, commissioned to take charge of **Cross**'s cinchonas from Kew to the Nilgiris in 1879 (all of which subsequently died). Whilst walking in the gardens at Calcutta he was killed by a tigress (Stewart, 1984). The orchid Biermannia was named in his honor.

Broughton, John

An analytical chemist, Broughton was appointed as Quinologist on the Nilgiris in June 1867. His reports were included in the Annual Cinchona Plantations Reports compiled by **McIvor**. An intense rivalry developed between the pair, based on the relative merits of the 'coppicing' versus 'mossing' methods of harvesting the cinchona bark. Broughton resigned and mysteriously disappeared in early 1875 after he was told to stop his production of Amorphous Quinine due to its high cost, only to turn up in New Zealand in 1881.

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703 Bidie's notebook. RBGK. JEH/1/47.

704 This and much of the information on Bidie's life taken from his obituary in the *British Medical Journal* (Anon, 1913). 1:473.

Campbell-Walker, Captain

Conservator of the Forests[705] in the Madras Presidency, who assumed the position of Conservator of State Forests in New Zealand in 1876. On his arrival back in India in January 1878 he was asked to inspect the Nilgiri Cinchona Plantations.

Cleghorn, Hugh Francis Clarke (1820-1895)

Born in Madras where his father was the Administrator-General in the Supreme Court. In 1824 he returned, with his parents, to the family estate near St Andrews, Scotland, and was educated in Edinburgh and St Andrews, studying medicine in Edinburgh between 1837 and 1841 where he developed an interest in botany. After graduation he was appointed to the Indian Medical Service (1842) and posted to Mysore. Whilst working as a doctor in Mysore, on the advice of **Joseph Hooker**, he began studying plants.[706] Cleghorn was often consulted on the medicinal and economic plants of India. In 1848, as a result of poor health, Cleghorn returned to England where in 1850-52, on the request of the British Association for the Advancement of Science (BAAS), he reported on the influence of tropical forests on the climate and resources of those countries. Seeing forests as an important economic resource, he returned to Madras in 1852 as Professor of Botany and Materia Medica in the Madras Medical College, and Secretary of the Madras Agri-Horticultural Society. He explored the forest resources in the Madras Presidency in detail (later advising railway engineers on the distribution and capabilities of different timbers), and became aware of the deforestation that was occurring (much caused by the construction of the railways), arguing that forest conservancy was necessary. In 1856 he was made the first Conservator of Forests in the Madras Presidency. In 1864-65, he (along with Dr Brandis) became the Joint Commissioner of Forests, advising the state in the general organization of forest administration at

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[705] As Barton (2001) explains, the arrival of James Andrew Broun Ramsey, Earl of Dalhousie as Governor-General of India in 1848, set in motion the "administrative and legal structures that became the Indian Forest Department and the model of forestry for the empire...Dalhousie issued on 3 August 1855, a Memorandum of the Government of India, the 'Charter of Indian Forestry'. The Charter declared annexation a ruling principle, and forests, if not privately owned, then state property by definition...with the establishment of forest areas as absolute state property, the Charter required proper management of the forest areas, and this meant scientific forestry." Barton sees this moment as the origin of environmentalism. "By the end of 1868 the Forest Department administered every province of the subcontinent, so that by 1885 the inspector general oversaw 10 Conservators of Forests, 55 Deputy Conservators of Forests, 38 Assistant Conservators of Forests, and thousands of forest guards" (2001:531-532).

[706] An activity typical of the Scottish medical surgeons employed in the IMS as they were trained in the French-influence Enlightenment tradition where disease, climate and plants and trees were clearly connected, hence their increasing employment as superintendents of botanical gardens in India.

the all-India level, and in 1865 the Government of India designated Cleghorn as the 'founder of Forest Conservancy in India'. He briefly held the post of Inspector-General of Forests in 1867 before retiring from Indian service in 1869. He was subsequently appointed as a confidential adviser to the Secretary of State in the India Office to select candidates for the Indian Forest Service (see Das, 2005). He died aged 75 in 1895. "In private life Dr. Cleghorn was one of the most charming of men; nothing could be more delightful than an evening with him, talking over his wide experiences in many lands, and his keen love of plants and trees" (Anon, 1895).

Cross, Robert Mackenzie (1834/6-1911)

Born on 24th April 1834/6 in Kilmaronock, Dunbartonshire, Scotland, Cross worked as a farm labourer in 1850, before serving his apprenticeship in the gardens of Sir James Colquhoun at Luss. This was followed by a term at Austin and McAslan's nurseries, Glasgow. In June 1857 he arrived at Kew where he worked until April 1859. Shortly after leaving he was appointed part of the cinchona expedition to Ecuador where he was to assist **Richard Spruce** in the collection of cinchona and to establish the plants in Wardian cases at Guayquil. He left Southampton in April 1860, and arrived back at Kew with around 500 cinchonas in January 1861, before travelling on to the Nilgiris with them. He declined to take up a position as Superintendent of the Naduvattam plantation and returned to South America and the Loxa forests of Ecuador in late 1861-62 (after Spruce had declined the Government's request to undertake the expedition to gather *Cinchona condaminea* seeds). In 1868 Cross was in South America again, charged with gathering plants and seeds of *Cinchona calisaya de santa fe* and he returned to Kew in 1870 with four cases of the plants. In 1871-75 he was in South America once more, where he spent time acquainting himself with the bark market. In 1875-76 he collected rubber plants from Panama and Brazil (a mission which ended in Cross being shipwrecked off the coast of Jamaica). In 1877-78 he continued his mission to collect *Cinchona calisaya de santa fe*, arriving at Kew with around 600 plants in March 1878, where he was employed to take charge of them during their stay in England. After those taken out by **Biermann** failed, Cross was finally employed to take out the remainder (now very small in number) to the Nilgiris in 1880, where he was asked to report on the plantations in 1881. In December 1881 he uncovered a supposedly dreadful mistake regarding the species chosen for cultivation in the

Nilgiris, but when he wasn't believed he immediately returned home to Edinburgh. He did not consider himself well looked after by the India Office, often complaining about his treatment in his letters to **Howard**. He moved to Torrance of Campsie in the 1890s where he remained until his death in 1911 aged 76. In his obituary, the *Journal of the Kew Guild* emphasized his bravery, "He made seven trips in all to South America. Of a retiring disposition, his work was not so well known to the public as it might otherwise have been. He was a typical Scotsman, with grit, and penetrated places in Panama that natives refused to enter, so afraid were they of its deadly climate" (Anon, 1911a).

Denison, Sir William Thomas (1804–1871)

The third son of John Denison of Ossington, Nottinghamshire, William was born in London. After attending a private school at Sunbury he spent four years at Eton College and then studied under a private tutor, the Revd C. Drury. In 1819 he entered the Royal Military Academy at Woolwich, passing for the Royal Engineers in 1823, and then working at the Ordnance Survey before receiving his commission as Lieutenant in 1826. In 1827 he was sent to Canada, where he was employed in the construction of the Rideau Canal (and subsequently awarded the Telford medal). He then worked for the Admiralty in Woolwich and Portsmouth, visiting Bermuda in 1842 to inspect dockyard works. In all three places he gained experience in dealing with convict labour. In 1846 he was nominated Lieutenant Governor of Van Diemen's land, and the recently knighted Denison arrived in present day Tasmania in early 1847. There he faced growing opposition from the Anti-Transportation League, but was promoted to Governor General of New South Wales in 1855 (along with this appointment came the title of Governor General of Australia). His wife Caroline Lucy whom he'd married in 1838, accompanied him to all his postings and over the years they had thirteen children. In 1860 the imperial government decided to appoint Denison governor of the Madras Presidency and in 1861 he took up the post where he gave much attention to public works like irrigation and communications. Following the death of Lord Elgin in late 1863, Denison was called on to assume the office of Governor General temporarily. He retired from the Madras Government in March 1866, the year the Denison family bought the Ossington estate (see entry for **Charles Denison** below). Whilst in Madras he took an active and supporting role in the cinchona experiment, and was pictured ceremoniously planting the first cinchonas in the Second Denison plantation at Naduvattam in the *Illustrated London News* (figure 6.9). In 1868 he was appointed Chairman of a Royal Commission to consider the pollution of British rivers, a position he held until his death in Surrey in 1871. "His abilities were solid rather than brilliant, but his great industry and unimpeachable integrity made him a distinguished public servant... in Madras he wanted a natural history of India. He corresponded with Sir Roderick Murchison on geography and population. With the strong religious convictions of a fundamentalist Anglican, he decidedly rejected the theories of Charles Darwin... he showed little interest in 'humane' disciplines which might have modified his severe judgments, though a tendency towards arrogance was modified in his private life, where he was warm-hearted and generous" (Arbuthnot, 2004). He also contributed specimens to the British Acclimatisation Society (Lever, 1992) and the RBGK.

Denison, Colonel Charles Albert (1819-1877)

Brother of **William Thomas Denison**, Charles was Lieutenant Colonel of 52nd Regiment, later Chief Commissioner of the Civil Service in Madras. He accompanied his brother to India in 1860 and was appointed Military Secretary to the Governor, an appointment he retained throughout William's office. When Lord Napier assumed the Governorship, Charles was appointed President of the Madras Municipality. He took charge of several estates on the Nilgiris for the Denison family back home; Welbeck, Belmont and Ossington,[707] the latter of which became one of the largest and most prosperous Cinchona plantations on the hills.

Elliot, Robert Henry (1837-1914)

An early British coffee planter in Mysore (a princely state neighbouring the Nilgiris), Elliot had arrived in Bombay in 1855 at the age of 18. He is one of few to record his experiences of plantation life in publication (see Elliot, 1871, 1898). He obtained around 200 Cinchonas from **McIvor** at Ootacamund in 1865 of which about twenty survived despite the lack of attention he gave them. He showed some of the bark produced to **John Howard**. At his farm Clifton Park in Scotland he also

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707 Letter from Charles Denison to Evelyn Denison, dated December 21st 1867. MSCN. OsC907/1-2.

formulated the 'Clifton Park System' that advocated building up the organic content of soil through planting a mixture of grasses and other plants.

Ferguson, John (1842-1913)

John Ferguson was born in Easter Ross, and trained as a journalist in Inverness and London before going to Ceylon in 1861 to become Assistant Editor of the *Colombo Observer*, under his uncle. He remained with the paper (renamed the *Ceylon Observer* in 1867) for almost 50 years, becoming the Proprietor and Editor after his uncle's death in 1892. He developed an active role in the political, commercial and cultural affairs of Ceylon, "and became closely involved in the tea, coffee, coconut and other planting trades for which he compiled and published statistics in his annually issued *Handbook and Directory of Ceylon*" (see Ferguson, 1878, 1885,1892, 1898).[708] He also founded the *Tropical Agriculturalist* in 1881 and the journal remained under his control until 1904 when the Agricultural Society assumed responsibility.

Gammie, James A. (1839-1924)

Gammie arrived at Kew in 1861, leaving about 1865 to take up an appointment as Manager of the Government Cinchona Plantations in Bengal (Anon, 1893:52). He was Deputy? Superintendent of the Bengal Cinchona Department until his retirement in 1897, also collecting plants in Sikkim for the Calcutta Botanic Gardens (Desmond and Ellwood, 1994). His son George Alexander Gammie (1864-1935) became Superintendent of the Saharanpur Botanic Gardens, Lloyd Botanic Garden at Darjeeling (outpost of the Calcutta Gardens) and Curator of Calcutta Botanic Garden.

Hasskarl, Justus Charles

German botanist who in 1854, in his position as Superintendent of the Dutch Botanic Gardens in Java, "travelled incognito[709] in Bolivia and smuggled out seeds

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[708] This quote and much of the biographical information taken from Institute of Commonwealth Studies catalogue entry, see http://www.aim25.ac.uk/cats/16/4625.htm [Accessed 16/01/10].
[709] He travelled under the assumed name J.K. Muller after news of his impending mission was prematurely publicised by a German daily newspaper (see Taylor, 1945).

of cinchona, which turned out to be of such low quality that the Dutch temporarily lost interest in growing cinchona" (Brockway, 1879b:456).

Hooker, Sir William Jackson (1785-1865)

Born in Norwich, William Hooker showed an early interest in botany and in 1809, after encouragement from Sir Joseph Banks, made an expedition to Iceland. After marrying he settled in Suffolk where he laid the foundations for his herbarium. In 1820 he was appointed Regius Professor of Botany at the University of Glasgow. He began the *Botanical Magazine* in 1826, and was knighted in 1836. In 1841 he was appointed Kew's first official Director where his contributions included the Palm House, Museums of Economic Botany, Herbarium and Library, the admission of the public to the Gardens on weekdays and the publication of an official guidebook. His extensive foreign correspondence and networks established Kew's position at the centre of botanical science.[710] In the early months of the cinchona experiment he supervised the planting of cinchonas at Kew, in a built for purpose propagating house.

Hooker, Sir Joseph Dalton (1817-1911)

Joseph Hooker trained as a doctor in Edinburgh, and between 1839 and 1843, he travelled as assistant surgeon and botanist on HMS Erebus, visiting Madeira, the Cape and the Antarctic. He travelled through northern Indian and Nepal (1848-51), surveying the flora and sending specimens back to Kew. His books include *The Rhododendrons of Sikkim-Himalaya,* two volumes of *Himalayan Journals* and *The Flora of British India.* Upon his father **William**'s death in 1865 he became Director of the Royal Botanic Gardens, Kew. He retired in 1885 and was succeeded by **William Thiselton-Dyer**, his son-in-law[711]. He was frequently consulted on the cinchona project.

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[710] See http://www.kew.org/heritage/people/hooker_w.html [Accessed 16/01/10].
[711] See http://www.kew.org/heritage/people/hooker_j.html. [Accessed 16/01/10]. For more information see Endersby, 2008., and www.jdhooker.org.uk [Accessed 16/01/10].

Hooper, David (1858-1947)

Born at Redhill, Surrey, and educated at Chelmsford. In 1878 he was awarded the Herbarium Bronze Medal presented by the Pharmaceutical Society of Great Britain for the best herbarium collected during the year by a pharmaceutical apprentice. His interest in plants continued, and he qualified as a pharmaceutical chemist in 1880, winning the Pereira Medal. He then spent three years working in pharmaceutical firms in London and in 1884 was appointed Quinologist to the Government of Madras (a position he held until 1896). Before taking up the appointment he spent six months in Holland studying the records and methods of the Dutch Cinchona enterprise. In the first half of 1896 he acted as Officiating Government Botanist and Director of Cinchona Plantations in Madras, becoming the Officiating Reporter on Economic Products to the Government of India after the departments were reshuffled. He held the reporting post again in 1898-99 and 1905, in 1902 being briefly Officiating Government Chemist. "His own post during this period 1897-1917, was that of Curator of the Economic and Art Section of the Indian Museum, and the fact that he was so frequently seconded to act for scientific colleagues is a tribute to his versatility and his profound knowledge of plants and their constituents" (Henry, 1948:253). On his retirement in 1914 he returned to England where during the First World War he supervised chemical work under the Ministry of Munitions. One of his most important works was *Pharmacographica Indica*, a three-volume work prepared in association with Indian Army Surgeons Dr. William Dymock and Dr. C. Warden. He was awarded the Hanbury Gold Medal in 1906. "Hooper was a man of untiring industry, and his modesty and pleasant manner won him many friends at whose disposal he was always ready to place his time and his unique knowledge" (Henry, 1948:255).

Howard, David

Nephew of **John Eliot Howard** who under took many chemical analyses on Government Cinchona bark.

Howard, John Eliot (1807-1883)

Born in Essex, the youngest child of Luke Howard (1772-1864), a meteorologist and chemist. Howard was largely educated at home, and became an apprentice at his father's chemical business at Stratford in 1823, becoming a partner in Howard & Sons[712] in 1828. He married in 1830 and settled in Tottenham, Middlesex where he had nine children. His first publication on quinine was a report on the collection of cinchona in the British Museum made by the Spanish botanist **José Pavón** in 1852. The following year he joined the Pharmaceutical Society and in 1857 the Linnean Society. After purchasing Pavón's manuscript in 1858, in 1862 he published the well-received *Illustrations of the Nueva Quinologia of Pavon...and Observations on the Barks Described.* From the very beginning of the British cinchona experiment, parcels of Nilgiri bark were regularly sent to Howard for analysis, the first sent in late 1861 in order to confirm species identity. His second major work *The Quinology of the East Indian Plantations* (1869-76) was the result of his examination of the cinchonas introduced into India. He was elected to the Royal Society in 1874. He took a considerable interest in gardening and raised cinchonas in his own greenhouse at his home in Tottenham (Howard, 1870). He corresponded extensively with **Robert Cross**. He died at home and was buried at Tottenham. The genus *Howardia* of the *Cinchonaceae* was posthumously dedicated to him (Boulger, 2004). His obituary in the *Pharmaceutical Journal and Transactions* emphasized his generosity, "Unceasingly he corresponded with collectors and cultivators; hundreds of specimens of bark from the Madras and Bengal plantations were analysed; plants were reared in his own greenhouses to assist in clearing up doubtful points as to doubtful origin; and the results of all these labours were at once and freely placed at the disposal of the public" (Anon, 1883b).

Karsten, H

Quinologist who published work on the cinchonas of New Granada.

Jago, Colonel

Deputy Conservator of Forests in the Madras Presidency, who officiated as Superintendent of Cinchona Plantations on the Nilgiris between 1881 and 1882.

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[712] For more on the company see Howard & Sons, 1897.

Jamieson, Andrew

Trained at Kew, Jamieson left for India in 1868 (Anon, 1893:57) to become Curator of the Botanic Gardens at Ootacamund. After McIvor's death in 1876 he also looked after the cinchona plantations on the Nilgiris, although the District Commissioner was placed in direct charge. Jamieson remained as Curator of the Botanic Gardens until around 1885.

Junghuhn, Franz Wilhelm (1809-1864)

Described as "The Humboldt of Java,"[713] Junghuhn was a German geographer and naturalist who joined the Netherlands Indies Army as a medical officer in 1834, arriving in Java in 1835. As a student he had suffered bouts of depression and attempted suicide. After involvement in a murder he was sentenced to ten years in prison, but after feigning insanity he had escaped in 1833. In 1845 he became a member of the Natural Sciences Commission and made numerous excursions in Java becoming Superintendent of the Dutch Cinchona Plantations on the island in 1856, where he remained until his death from liver disease in 1864. His most notable achievement was the first full geographical, geological and botanical description of Java, *Die Topographischen und Naturwissenschaftlichen Reisen durch Java* (1845).

King, George (1840-1909)

Born in Aberdeen, and died in San Remo, Italy. King was awarded a Bachelor of Medicine from Aberdeen in 1865, and entered the Bengal Medical Service in 1865. In 1868 he was placed in charge of the Gardens at Saharanpur, becoming Superintendent of the Calcutta Botanic Gardens, (and Superintendent of the Cinchona Plantations in Bengal), and Professor of Botany in 1871. At Calcutta he oversaw the expansion of the gardens (including a distant annexe at Darjeeling known as the Lloyd Botanic Garden), and new buildings including a fireproof herbarium to house a rapidly growing collection of specimens. He is particularly remembered for the great horticultural designs that he introduced at Calcutta, where work was needed after the disastrous cyclone of 1864. In 1887 he started the

[713] See: http://dieny-yusuf.com/2007/12/12/franz-wilhelm-junghuhn/ [Accessed 16/01/10].

Annals of the Royal Botanic Garden, Calcutta, and became a Fellow of the Royal Society. King also became Director of the Botanical Survey of India 1891-98. He published his *Manual of Cinchona Cultivation in India* in 1876, which was reprinted in 1880. He visited the Nilgiri plantations in 1871, 1878 and 1895, in 1895 recommending the abandonment of the Wood plantation. He collected plants in the Andaman Islands, India, Burma and the Philippines. He took six Para rubber tree plants (*Hevea brasiliensis*) to Calcutta from Kew in 1873, and was warm friends with **Sir Joseph Hooker** (Hastings, 1986). He was awarded Knight Commander of the Indian Empire in 1905 (Desmond and Ellwood, 1994).

Lascelles, Arthur Rowley (1830-?)

A resident of Ootacamund and one of the first individuals to request a supply of cinchona plants (numbering 100,000) from **McIvor** in 1862, on behalf of the newly formed *Western Neilgherry Coffee Tea and Cinchona Plantation Company Limited.* He also applied for plants from Kew. As Managing Director of the Moyar Coffee Company he published *A Treatise on the Nature and Cultivation of Coffee; with some Remarks on the Management and Purchase of Coffee Estates* (1865).

Lawson, Marmaduke Alexander (1840-1896)

Born in Durham, Lawson became Professor of Botany at the University of Oxford in 1868 where he remained until 1882 when he was appointed as Superintendent of the Government Cinchona Plantations in Madras (Desmond and Ellwood, 1994). He remained in the post until 1896, retiring shortly before his death.

Ledger, Charles (1818-1905)

Born in Stockwell, London, Ledger travelled to Peru in 1836 where he became a dealer in South American produce, particularly alpaca wool. In 1848 he began to breed alpacas and in 1858 took alpacas to New South Wales in 1858 on the request of British consular officials. Upon arrival in Sydney with 256 alpacas, llamas and vicunas, "commercial interest had waned and plans to float a company to buy the flock were abandoned...he submitted his resignation three times in 1859-61" (Andrews, 1974:73). After he was accused of misappropriating money given to him by the Acclimatisation Society of Victoria he decided to return to South America in

1864. In Bolivia his servant Manuel Incra Manami had spent the last four years collecting cinchona seeds and in 1865 Ledger managed to export a parcel of the now famous *Cinchona ledgeriana* which were to become the foundations of the Dutch plantations in Java after the seed was refused by the British. A small parcel did make its way to the Nilgiris care of **Mr. Money**. He returned to Australia in 1884 where he died in 1905, his estate valued at only £2.[714]

Ledger, George

Brother of Charles (see above), who received the important *Cinchona ledgeriana* seeds in London in 1865. After the British authorities failed to show any interest in them, **John Eliot Howard** (see above), who appreciated their commercial potential, put George in touch with Dutch experts who purchased the seeds.

Markham, Clements Robert (1830-1916)

Born in Stillingfleet, Yorkshire, after school Markham joined the Royal Navy as a cadet, first sailing on HMS *Collingwood* to South America where he learned Spanish in addition to the standard navel curriculum. He showed an interest in Arctic exploration from an early age, and in 1850 sailed on the *Assistance* in search of Franklin. After leaving the Navy, in 1852 he travelled to Peru where he explored Inca sites and read manuscripts for his *Cuzco...and Lima* (1856). He retained an interest in Peru for the rest of his life. In 1854 he joined what was to become the India Office, where he volunteered himself to lead the expedition to gather cinchonas in Peru for the establishment of plantations in British India. His *Travels in Peru and India* (1862) and *Peruvian Bark* (1880) recount his adventures. He was accompanied by his wife **Minna** and the gardener **John Weir**. His plants were the first to arrive in the Nilgiris in October 1860, and Markham and Minna remained on the hills with the plants until January 1861. Although all his plants died within a short time, Markham was awarded a grant of £3,000 for his services. Back in England, he returned to the India Office where he set himself the task of cataloging the maps and reports of the various Indian surveys (Williams, 1968). He returned to the Nilgiris in 1866 where he was impressed with the dramatic progress and gathered information for his map of the plantations of 1866. In 1867-68 he once

[714] For more information see Taylor, 1945, Vietmeyer, 1971 and Gramiccia, 1987b, 1988.

again took leave to act as geographer and naturalist to the British contingent in the Abyssinian expedition. He was forced to resign from the India Office in 1877, by which time he had already become active in both the RGS and Hakluyt Society. He helped muster support for the 1875 north polar expedition. In the RGS, he served as Secretary (1863-88) and President (1893-1905), and in the Hakluyt Society he was Secretary (1858-86) and President (1889-1910). He was instrumental in getting the *Discovery* (or National Antarctic) Expedition (1901-04) under Robert Falcon Scott underway. He published extensively and was made CB in May 1871, elected FRS in 1873, and created KCB in 1896. He died at home in London when he set fire to his bedclothes while reading by candlelight. A description of him as "in all things an enthusiast rather than a scholar neatly encapsulated his strength and weakness, and helps to explain his extraordinary influence, probably second only to that of Sir Roderick Murchison, on geography and its institution in Britain in the nineteenth and early twentieth centuries" (Baigent, 2004).[715]

Markham, Minna

Daughter of a Devonshire clergyman, the Rev. James Chichester, and wife of **Clements Robert Markham** whom she married in 1857. Minna was a linguist and literature enthusiast who accompanied her husband on his expeditions to South America and India, keeping diaries of her experiences, and contributing to his work. 'Minna Bluff' in Antarctica was named after her by Markham's close friend the explorer Robert Scott.

Macpherson, Dr.

Inspector General of Hospitals, who was instructed by Government to visit the Nilgiris early in 1861 to inspect and report on the sites selected by **McIvor** for the nursery and plantation at Dodabetta. Macpherson was selected for this duty largely because he had recently visited the Dutch plantations in Java. His negative comments prompted government intervention in **McIvor**'s plans which angered the Superintendent.

[715] For an informal but uncritical biography of Markham also see the account of his life by his cousin, close friend and colleague Albert Markham (Markham, 1917).

McIvor, William Graham (1825-1876)

Born in Dollar, Scotland, William McIvor was the son of a farmer who trained at the Royal Botanic Garden Edinburgh before working as a gardener at Kew from 1845, until he was appointed Superintendent of Ootacamund Botanical Garden in 1848, assuming the additional title of Superintendent of Cinchona plantations in 1860. He held both posts until his death in 1876. He is widely credited with the acclimatization of the cinchona to India and seemingly worked tirelessly for the cause. His 'mossing' process (see Anon, 1866) of renewing the bark on the trees is considered his most important contribution. He published *Notes on the Propagation and Cultivation of Medicinal Cinchonas or Peruvian Bark Trees* in 1863. In April 1871 he visited and reported on the cinchona plantations at Darjeeling. In 1874-5 his debate with **Broughton** regarding mossing versus coppicing reached its height and McIvor was clearly distressed over the matter. He died the following year at Ootacamund in 1876 aged 51. His obituary in the *Gardener's Chronicle* read, "The success of the Cinchona experimental cultivation on the Neilgherries is mainly due to Mr. McIvor's exertions... when that chronic curse of India, fever, which now allays nearly 1,750,000 of our fellow-subjects per annum, has been grappled with by the bringing of the Cinchona febrifuge within every man's reach, it will be admitted that Mr. McIvor's life was eminently one of great present and future usefulness to his fellow beings. The news of his death will take most people by surprise, for he lived an eminently healthful life; he was blessed with a robust constitution...he had work to do that it was an abiding pleasure to him to perform; he was a model of abstemiousness, moderation and domesticity; and his circumstances illustrated the affluence resulting from national thrift... Most of the chief officers of Government on the Hills attended his funeral at Ootacamund..." (Anon, 1876a).

McIvor, Ann(e)

Wife of **William McIvor** whom she married in 1848 at Ootacamund. Described in her husband's obituary as "an exemplary wife" (Anon, 1867a), she outlived her husband and maintained an interest in cinchona after his death, being a large shareholder in the Ossington Cinchona Estate (inherited from her husband). In 1879 she visited England and **John Howard**, and later wrote to him and also conversed with **Robert Cross** during his stay on the hills.

(Mc)Nicholl, William

Trained at Kew, he left in 1860 for Ceylon (Anon, 1893), and was placed in charge of the first cinchona plantations on the island, also performing administrative work regarding the distribution of plants to private planters.[716]

Money, James William Bayley (1818-1890)

Referred to as a "gentleman from Bengal,"[717] Money was the author of *Java, or, how to Manage a Colony: Showing a Practical Solution of the Questions Now Affecting British India* (1861), a book focusing on the set of policies known at the 'Cultivation System' which was introduced as a means of covering the high cost of colonial administration in Java. Participating villages were required to grow export crops to raise funds sufficient to meet the land-tax commitment which was based on rice production. The export crops (coffee, indigo, sugar, tea, cinnamon, pepper, tobacco, cotton, silk and cochineal) were sold to the government at fixed prices, establishing a balance between rice production and export crops, supposedly benefitting all.[718] In India, Money moved from Bengal to the Nilgiris and was one of the first to establish a private cinchona venture. His Deva Shola estate grew to be one of the largest and most successful cinchona plantations. Later he became involved in the Nilgiri Chinchona Company, and was a shareholder in the Ossington estate. He often voiced his opinions on the cinchona market in the *SIO*.

Morgan, Captain/General G.R.

Officiating Conservator of Forests who supported **McIvor** early in 1861 insisting that **Macpherson**'s comments were unjustified and inaccurate, also questioning the success of the Dutch plantations.[719] Apparently divorced against his will from the government part of the experiment he conducted his own experiments in cinchona cultivation from 1863. He was one of the more successful cinchona planters on the Nilgiris, who achieved record prices for his bark in 1877.[720]

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716 "Notes – Ceylon, India and Spain, 1865-66". RBGK. CRM/17.
717 AAR, 1864-1865. BPP, 1866:164.
718 http://countrystudies.us/indonesia/11.htm [Accessed 16/01/10].
719 Letter from Captain Morgan to J.D. Bourdillon, dated 28th March 1861. BPP, 1863:153-154.
720 BL. *SIO*. 9th May 1877. p.2.

Morris, Mr.

Original Superintendent of the Cinchona Plantations in Jamaica.

Mutis, José Celestino (1732-1808)

Mutis studied medicine at Seville and Madrid, and travelled to South America as physician-in-ordinary to the newly-appointed Viceroy of New Granada, remaining in New Granada for 50 years. After settling in Mariquita after he was appointed leader of the 'Expedición botánica del Nueva Reino de Granad', he laid out a plantation of cinchona (observed by Humboldt). "His museum consisted of 24,000 dried plants, 5,000 drawings of plants by his pupils, and a collection of woods, shells, resins, minerals, and skins...While he was not the first to discover the genuine cinchona for New Granada... he rendered important services by his study of the cinchonas...This is shown by the trade, which developed in such a manner that (e.g.) the seaport of Cartagena alone exported from New Granada 1,200,000 pounds of cinchona bark in 1806, while previous to 1776 this country produced no quinquina at all."[721] His chief work *El arcane de la quina* was sent to Madrid where it lay buried in a shed at the Botanical Gardens until **Clements Robert Markham** discovered it.

Pavón, José Ambrosio (1754-1844)

Worked in South America between 1778 and 1788 and, "alone, or with Hippolito Ruiz Lopez, described eight of the 23 species [of Cinchona] recognized by Andersson (1998) and also provided type specimens for two. His samples were transferred to Kew from the British (now Natural History) Museum in London in 1982-1983" (Prendergast, 2001:3). **John Eliot Howard** published his work on Pavon's specimens, *Illustrations of the Nueva Quinologia of Pavon* in 1862.

Planchon, Dr Gustave (1823-1888?)

French quinologist.

721 http://www.newadvent.org/cathen/10659b.htm [Accessed 16/01/10].

Pritchett, G. J

Assistant gardener to **Richard Spruce** on the 1859-60 cinchona expedition to South America. His seeds arrived on the Nilgiris on the 13th January 1861, after Markham's had plants had all failed, and were the first to germinate on the hills.

Rhode, J

Inspector General of Gaols during the introduction of convict labour on the cinchona plantations in 1864. Rhode was also a successful cinchona planter who owned the Balmadie estate (commenced in 1866), one of the more successful cinchona plantations on the Nilgiris, which featured in an illustration in the *ILN* in 1872 (figure 6.11).

Royle, John Forbes (1798-1858)

Surgeon and naturalist. In 1823 he became Superintendent of the EIC's botanic garden at Saharanpur where he studied and published on Indian medicine and reported on Indian products to the EIC. In 1831 he returned to England where he recommended the introduction of cinchona plants into India (Woodward, 2004).

Spruce, Richard (1817-1893)

Born near Castle Howard in Yorkshire, Spruce was educated by his father who was a teacher. By the age of 19 he had written a Flora of the Malton District, and became an expert in mosses and liverworts. Between 1845-46 he carried out a major expedition to the Pyrenees. In 1848 he was approached by **William Hooker** as a potential candidate to carry out a botanical exploration of the Amazon. Although his health wasn't good he set sail for South America in 1849 at the age of 31. In the next fifteen years he travelled to Brazil, Venezuela, Peru and Ecuador (where he collected Cinchona seeds). "The extent of his travels was no mean feat for a man who by the time he left South America was deaf in one ear, could not walk at all without pain due to paralysis of his legs and back and had long-standing suspected tuberculosis."[722] He died in Yorkshire in 1893[723].

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[723] See: http://www.nhm.ac.uk/jdsml/research-curation/research/projects/spruce/INTRODUCTION/introduction_spruce.dsml [Accessed 16/01/10].

Standen, W.M.

Superintendent of Government Cinchona Plantations for three periods, 1896-1901, 1903-1908, and 1909-1912.

Thiselton-Dyer, William Turner (1843-1928)

Thiselton-Dyer first studied mathematics at Oxford, later turning to natural science, graduating in 1867. After holding the positions of Professor of Natural History at the Royal Agricultural College in Cirencester and Professor of Botany at the Royal College of Science in Dublin, he took up a professorship at the Royal Horticultural Society in London in 1872, on the recommendation of **Sir Joseph Hooker**, his father-in-law. In 1875 he became Assistant Director at Kew, under Sir Joseph. He corresponded extensively on the cinchona project and was also devoted to the introduction of rubber to Ceylon and Malaya and the introduction of cacao to Ceylon from Trinidad. In 1877 he was given charge of an international research laboratory erected at Kew with private sponsorship, which became known as one of the best laboratories in Europe. Upon Sir Joseph Hooker's retirement in 1885, Thiselton-Dyer was appointed Director of Kew, creating the Alpine House and completing the Temperate House, the largest glass house in the world. He retired from his post in 1905.[724]

Trimen, Dr Henry (1843-1896)

Educated at King's College, London, and the University of London, Trimen became Curator of the Anatomical Museum of King's College and then Lecturer on Botany at St Mary's Hospital. In 1869 he was appointed Senior Assistant in the Botanical Department of the British Museum. From 1872-79 he edited the *Journal of Botany*, and in 1880 he was appointed Director of the Royal Botanic Gardens, Ceylon. "He gave special attention to economic botany, was the means of introducing into Ceylon many useful products of other countries, and made an important investigation for the Madras Government on the cinchona plantations in the Nilgiris" (Anon, 1896b).

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723 For more information see Seaward and FitzGerald, 1996.
724 See: http://www.rbgkew.org.uk/heritage/people/thiselton_dyer.html [Accessed 16/01/10].

Vrij (or Vry), Dr De

Colleague of **Junghuhn** (see above), De Vrij corresponded with **John Howard**, and was on occasions asked to undertake the analysis of Nilgiri bark.

Van Gorkom (1835-1910)

Junghuhn's successor as Superintendent of the Dutch Cinchona Plantations in Java, acting from 1864-73. Van Gorkom raised thousands of plants from *Cinchona ledgeriana* seed obtained by **Charles Ledger**, and arranged for the production of seed of *Cinchona ledgeriana* derived from so-called mother trees, chosen on only for yield of quinine but also for their horticultural qualities like thrifty growth, and thickness of bark, thereby providing a reliable and popular supply of seed for private planters. He died back home in Holland.

Weddell, Dr Hugh Algernon (1819-1877)

Weddell was born in Gloucester but raised in France where he received a medical degree in 1841. He also studied botany and explored South America extensively. Before leaving Paris he had been instructed by the Museum National d'Histoire Naturelle to undertake an analysis of the cinchona plant. Weddell identified fifteen distinct species of the tree and the seeds he took back to Paris in 1848 germinated in the Jardin des Plantes, some of which found their way to Java. He published *Histoire naturell des Quinquinas* in 1849, and corresponded extensively with **John Eliot Howard**.

Weir, John

A practical gardener who accompanied **Clements Markham** on his cinchona collecting mission to South America of 1859-60. Markham later blamed Weir for the failure of his plants but he was offered the Superintendency of the Naduvattam plantation but he had already sailed for Brazil for the Horticultural Society.[725]

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725 Letter from Markham to Under Secretary of State for India, dated 30th May 1861. BPP, 1863:168.

Appendix C - Dates of Office

Dates of office are estimated from archival sources and may contain some inaccuracies.

- The Nilgiris

District Commissioners/Collectors of the Nilgiris District[726]

(Collectors were designated Commissioners up to 31st January 1882)

Breeks, J.W.	01/08/1868 to 19/06/1872
Cockerelly/Cockerill, J.R	20/06/1872 to 20/10/1876
Comyu, W.H.	21/10/1876 to 12/12/1876
Webster, A.M.	13/12/1876 to 17/03/1878 (also in overall charge of cinchona plantations)
Barlow, R.W.	18/03/1878 to 20/05/1880 (also in overall charge of cinchona plantations)
Roupell, N.A.	21/05/1880 to 26/11/1881 (also in overall charge of cinchona plantations)
Barlow, R.W.	27/11/1881 to 16/10/1882
Arkinson, A.J.B.	17/10/1882 to 21/03/1883
Brandt, F.	22/03/1883 to 08/02/1884
Burrows, L.R.	09/02/1884 to 08/04/1889
Maccartie, C.F.	09/04/1889 to 15/12/1891
Rees, J.D.	16/12/1891 to 18/01/1883
Murray, F.D.O.	19/01/1893 to 21/12/1893
Rees, J.D.	22/12/1893 to 14/04/1895
Sim, H.A.	15/04/1895 to 18/07/1895
Rees, J.D.	19/07/1895 to 29/11/1895

726 The dates of office have been taken from http://nilgiris.nic.in/collectoroff.htm [Accessed 16/01/10].

Rowson, E.C.	30/11/1895 to 08/04/1896
Rees, J.D.	09/04/1896 to 15/08/1896
Tremenhere, J.H.A.	16/08/1896 to 16/11/1897
Stuart, H.A.	17/11/1897 to 16/11/1897
Cowie, D.W.G.	21/02/1898 to 26/05/1898
Tremenhere, J.H.A.	27/05/1898 to11/06/1898
Cowie, D.W.G.	12/06/1898 to 26/07/1898
Butterworth, A.	27/07/1898 to 31/01/1899
Weir, C.J.	01/02/1899 to 17/06/1899
Roberts, S.G.	18/06/1899 to 01/08/1899
Weir, C.J.	02/08/1899 to 30/12/1899
Mullay, C.M.	31/12/1899 to 30/07/1901

- Madras

Governors of Madras[727]

(I have chosen to begin the list of Governors in the late 1820s when the Nilgiri region was gaining popularity).

Sir Thomas Munro	16/09/1814 to 10/07/1827
Henry Sullivan Graeme (acting)	10/07/1827 to 18/10/1827
Stephen Rumbold Lushington	18/10/1827 to 25/10/1832
Sir Frederick Adam	25/10/1832 to 04/03/1837
George Edward Russell (acting) -	04/03/1837 to 06/03/1837
John Elphinstone (Baron Elphinstone)	06/03/1837 to 27/09/1842

727 Exact dates of office have been taken from http://www.worldstatesmen.org/India_BrProvinces.htm#North-West [Accessed 16/01/10].

George Hay (Marquess of Tweedale) -	24/09/1842 to 23/02/1848
Henry Dickinson (acting)	23/02/1848 to 07/04/1848
Sir Henry Eldred Pottinger	07/04/1848 to 24/04/1854
Daniel Eliott (acting)	24/04/1854 to 28/04 1854
George Francis Robert Harris (Baron Harris)	28/04/1854 to 28/03/1859
Sir Charles Edward Trevelyan	28/03/1859 to 08/06/1860
William Ambrose Morehead (acting) -	08/06/1860 to 05/07/1860
Sir Henry George Ward	05/07/1860 to 02/09/1860
William Ambrose Morehead (acting)	04/09/1860 to 18/02/1861
Sir William Thomas Denison	18/02/1861 to 26/11/1863
Edward Maltby (acting)	26/11/1863 to 18/01/1864
Sir William Thomas Denison	18/01/1864 to 27/03/1866
Francis Napier (Baron Napier of Merchistoun)	27/03/1866 to 19/02/1872
Alexander John Arbuthnot (acting)	19/02/1872 to 15/05/1872
Vere Henry Hobart	15/05/1872 to 29/04/1875
William Rose Robinson (acting)	29/04/1875 to 23/11/1875
Richard Plantagenet Campbell (Temple-Nugent-Brydges-Chandos-Grenville, Duke of Buckingham and Chandos)	23/11/1875 to 20/12/1880
William Patrick Adam	20/12/1880 to 24/05/1881
William Huddleston (acting)	24/05/1881 to 05/11/1881
Mountstuart Elphinstone Grant Duff	05/11/1881 to 08/12/1886
Robert Bourke (from 1887 Baron Connemara)	08/12/1886 to 01/12/1890
John Henry Garstin (acting)	01/12/1890 to 23/01/1891

Bentley Lawley (Baron Wenlock)	23/01/1891 to 18/03/1896
Sir Arthur Elibank Havelock	18/03/1896 to 28/12/1900

- Bengal

Superintendent of Cinchona Plantations

Anderson, Thomas	1862-1869
Mr D.B. Clarke	1870-1871
King, Dr George	1871-1880?
Gammie	1880-1897?

Superintendents of (Royal)[728] Botanic Gardens, Howrah, Calcutta[729]

Lieutenant Colonel Robert Kyd	1788-1793
Dr William Roxburgh	1793-1814
Dr Nathaniel Wallich	1817-1846
Dr W. Griffith	1846-
Thomas Anderson	1861-1868
C.B Clarke (officiating)	1868-1871
Sir George King	1871-189?

728 The epithet 'Royal' came to be applied after the Queen's proclamation of 1858.
729 Much of this information has been taken from Hastings, 1986.

- Ceylon

Superintendents of Royal Botanical Gardens, Peradeniya, Ceylon[730]

W. Kerr	1812-1816
Alexander Moon	1816-1825
A. Walker (acting)	1825-1827
J. MacRae	1827-1830
G. Bird (acting)	1830-1832
J.G. Watson	1832-1838
J.G. Lear (acting)	1838-1840
H.T. Normansell	1840-1843
W.C. Ondaatje (acting)	1843-1844
George Gardner	1844-1849
Dr George Henry Kendrick Thwaites	1849-1880
Dr Henry Trimen	1880-1896
Dr J.C. Willis	1896-1912

- Java

Superintendents of Dutch Cinchona Plantations, Tjibodas and Bandung, Java

Hasskarl, Justus Charles (unofficial)	
Franz Wilhelm Junghuhn	1856-1864
Dr K.W. van Gorkom	1864-1873
Bernelot Moens employed as chemist on	

730 Macmillan, 1906:5.

March 22 1872 then director 1900-

Chemist Mr van Leersum

Romunde?

Groothoff?

Kerbosh

M.A. van Roggen 1940s

- London

Directors of Royal Botanic Garden, Kew

Sir William Hooker	1841-1865
Sir Joseph Hooker	1865-1885
Sir William Turner Thiselton-Dyer	1885-1905

Secretaries of State for India (based in India Office, London)[731]

Edward Henry Stanley (Lord Stanley)	02/09/1858 to 18/06/1859
Sir Charles Wood	18/06/1859 to 16/02/1866
George Frederick Samuel Robinson (Earl of Ripon)	16/02/1866 to 06/07/1866
Robert Arthur Talbot Gascoyne-Cecil (Viscount Cranborne)	06/07/1866 to 08/03/1867
Sir Stafford Henry Northcote -	08/03/1867 to 09/12/1868
George Douglas Campbell (Duke of Argyll)	09/12/1868 to 21/02/1874
Robert Arthur Talbot Gascoyne-Cecil (Marquess of Salisbury) -	21/02/1874 to 02/04/1878
Gathorne Hardy (Viscount Cranbrook) -	02/04/1878 to 28/04/1880

731 Exact dates of office have been taken from http://www.worldstatesmen.org/India.htm [Accessed 16/01/10].

Spencer Compton Cavendish (Marquess of Hartington)	28/04/1880 to 16/12/1882
John Wodehouse (Earl of Kimberley	16/12/1882 to 24/06/1885
Randolph Henry Spencher Churchill	24/06/1885 to 06/02/1886
John Wodehouse (Earl of Kimberley) -	06/02/1886 to 03/08/1886
Sir Richard Assheton (from 18th August 1886 Viscount Cross)	03/08/1886 to 18/08/1892
John Woodhouse (Earl of Kimberley)	18/08/1892 to 10/03/1894
Henry Hartley Fowler	10/03/1894 to 04/07/1895
Lord George Francis Hamilton	04/07/1895 to 09/10/1903

Permanent Under-Secretaries of State for India (based at India Office, London)[732]

Sir George Russell Clerk	1858-1860
Herman Merivale	1860-1874
Sir Louis Mallet	1874-1883
Sir Arthur Godley	1883-1909

[732] Dates of office taken from http://www.absoluteastronomy.com/topics/Under-Secretary_of_State_for_India [Accessed 16/01/10].

Appendix D – Primary Archival Collections Consulted

This summary lists the primary collections of manuscript archival material consulted, along with catalogue numbers (organized alphabetically by archival repository). Please note that this is not an exhaustive list of all material utilized within the study as all published material is included in the bibliography).

Bodleian Library, Oxford (BLO)

Map of the Neilgherries, Koondahs, and Wynaad to illustrate the progress of chinchona cultivation up to July 1866.
Catalogue reference: Map Room (Maps). D10:25 (10).

Ootacamund hunt map (revised edition 1920).
Catalogue reference: Map Room (Maps). D10:25 (19).

Map of the Neilgherry mountains. : Reduced from Captain J. Ouchterlony's survey.
Catalogue reference: Map Room (Maps). D10:25 (22).

British Library (BL)

Planting Directories for Southern India (*c.*1878-1965).
Catalogue reference: Oriental Collections ST 1447, and various others (see bibliography).

South of India Observer (*SIO*) (1877-1887).
Catalogue reference: Oriental Collections SM 83.

Reports on the Horticultural and Botanical Gardens, Ootacamund (1855-60), (RHBGO).
Catalogue reference: Oriental Collections: IOR/V/24/1688.

Annual Administration Reports (AAR) on the Government Cinchona Department, Nilgiris, Madras (1892-1942).

Catalogue reference: Oriental Collections. IOR/V/24/564–565.

India Office Select Materials – Private Papers

- Letter dated 6th June 1860 from Sir William Jackson Hooker (1785-1865), botanist and director of Kew Gardens, to Herman Merivale (1806-74), Under Secretary of State for India, concerning Hooker's scheme for growing cinchona in India. 2 folios.
  Catalogue reference: Mss Eur A170.
- Letters dated Aug 1860 to March 1881 from Sir Clements Robert Markham (1830-1916), clerk at the Board of Control 1854–58 and on the staff of the India Office 1858-77, to Richard Henry Major (1818-91) Keeper of Maps and Plans at the British Museum 1867-80, concerning the transplantation of Peruvian cinchona trees to the Nilgiri Hills, Madras. 7 folios.
  Catalogue reference: Mss Eur A.82.

India Office Select Materials – Prints and Drawings

- George Hutchins Bellasis' watercolours (1850s)
  Catalogue reference: WD2284–2320
- Sir Richard Strachey's scrapbooks (1830s-1860s)
  Catalogue reference WD2331 and WD2332

India Office Select Materials – Photographs

- Goshen collection (1920s)
  Catalogue reference 431
- Album by Samuel Bourne (1869)
  Catalogue reference 11
- Ellis collection (*c.* 1901)
  Catalogue reference 304
- Spalding collection (1880s)
  Catalogue reference 335
- Penn collection (1890s)
  Catalogue reference 1115
- Archaeological survey of India collections (1860s)
  Catalogue reference 1000

- Set of lantern slides illustrating the cultivation of cinchona and the manufacture of Quinine Sulphate at Bengal (1906-16)
  Catalogue reference 397

Cambridge University Library (CUL)

RCS collection including a wide range of nineteenth century published texts on cinchona and the Nilgiris and the photograph collection of John Abercromby Alexander GBR/0115/Y303E. Prints 45-47.

Derbyshire Record Office (DRO)

Papers of the Gell Family of Hopton, Derbyshire.
Catalogue reference: D3287. Particularly items D3287/8, D3287/40, D3287/84 and D3287/100.

London Metropolitan Archives (LMA)

Papers of Howard and Sons (manufacturers of pharmaceutical chemicals).
Catalogue reference ACC/1037.

National Archives of Scotland (NAS)

Records of the Board of Trade files of dissolved cinchona companies.
Catalogue reference: BT2/783 and BT2/7592.

Nottinghamshire Archives (NA)

Articles of Partnership. Denison Family Indian Estates Papers, 30th December 1886.
Catalogue reference DD/1440/39/1.

Royal Botanic Gardens, Kew (RBGK)

Papers relating to John Eliot Howard (1836-1951).

Catalogue reference JEH, primarily JEH/1/11, 12, 16, 25, 27, 37, 44, 47, JEH/2/3-6, 20 and JEH/3/5.

The Pharmaceutical Journal (see bibliography).

Miscellaneous Reports (MR):

- Madras. Cinchona. 1860-1897.
- Madras. Cinchona Reports. 1861-1885 (*Annual (Administration) Reports of the Government Cinchona Department, Nilgiris, Madras).*
- Madras. Cinchona Reports. 1885-1900 (*Annual (Administration) Reports of the Government Cinchona Department, Nilgiris, Madras*)
- India. Economic Products. Cinchona. *c.*1859-1888.

Directors Correspondence (DC), items received from William McIvor at Ootacamund.
Catalogue reference DC Vol 25. f. 281, Vol 54. ff. 318, Vol. 54. ff. 341, and Vol. 57. f. 109.

Goods Inwards, items received from William McIvor at Ootacamund.
Catalogue reference: 1848-1858, ff. 35, 38, 41, 56, 145, 160 and 1859-1867.

Economic Botany Collection – cinchona bark samples (India).
Catalogue reference: various.

Royal Geographical Society (RGS)

Clements Robert Markham Collection.
Catalogue reference: CRM. In particular CRM/17, 22, 23, 52, 55, 56, 67, 68, and 69.

The National Archives (TNA)

Records of the Board of Trade files of dissolved cinchona companies.
Catalogue reference BT 31 2809/15386, BT31/31539/53121, and BT 31/716/109c

Records of the works departments: Royal Parks and Pleasure Gardens: Plans and Drawings. Plan of Cinchona Propagating House at Kew, 1860.
Catalogue reference: WORK/32/381.

University Library, Cambridge (ULC)

Royal Commonwealth Society (RCS): Collection of published books and articles on cinchona (see bibliography).
Catalogue reference: RCS various.

University of Nottingham, Manuscripts and Special Collections (MSCN)

Papers of William Henry Cavendish-Scott-Bentinck, 4th Duke of Portland (1768-1854) in the Portland (Welbeck) Collection.Bentinck papers.
Catalogue reference: PwH 302-306.

Papers of Sir William T. Denison (1804-1971), and his family.

- Correspondence.
  Catalogue reference: De Wm C, particularly items De Wm C 96/1/1-2, De Wm C 74/1-2, De Wm C 75, DeWm C 57/1, and De Wm C 58/1.
- Official papers.
  Catalogue reference: De Wm O, particularly items De Wm O 8.

Papers of John Evelyn Denison, Viscount Ossington (1800-1873), and his family.

- Correspondence.
  Catalogue reference Os C, particularly items Os C 868a and Os C 907/1-2.

Online Archives:

British Parliamentary Papers/Blue Books (BPP)
(http://parlipapers.chadwyck.co.uk/home.do):

- *Copies of all Papers Relative to the Formation of a Sanitarium on the Neilgherries for European Troops, 1821-1836* (1850). Abbreviated BPP, 1850.
- *Correspondence Relating to Introduction of Chinchona Plant into India, and Proceedings Connected with its Cultivation, 1852-63* (1863). Abbreviated BPP, 1863.
- *Correspondence Relating to Introduction of Chinchona Plant into India, and Proceedings Connected with its Cultivation, 1863-66* (1866). Abbreviated BPP, 1866.
- *Correspondence Between Secretary of State for India and Governor General, and Governors of Madras and Bombay, Relating to Cultivation of Chinchona Plants, 1866-70* (1870). Abbreviated BPP, 1870.
- *Further Correspondence Relating to Cultivation of Chinchona Plants, 1870-75* (1877). Abbreviated BPP, 1877.

The Times Online (http://archive.timesonline.co.uk/tol/archive/)

The Scotsman Online (http://archive.scotsman.com/)

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