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Empire and Alternatives: *Swietenia febrifuga* and the Cinchona Substitutes

PRATIK CHAKRABARTI *

Introduction

This paper focuses on a cinchona substitute, the *Swietenia febrifuga* (also known as *Soymida febrifuga*¹), whose medical virtues for treating intermittent fevers were discovered in India around 1791 by William Roxburgh, the English East India Company (EEIC) surgeon in charge of the Company's botanical garden in Samulcottah (north of Chennai or Madras). The bark was subsequently subjected to several experiments in three main cities, Samulcottah, Madras (the EEIC headquarters on the east coast of India) and Tranquebar (the Danish base on the same coast). The research and promotion of the bark were carried out by Roxburgh, other surgeons, missionaries and also the EEIC's commercial agents.

One reason for such an interest in the bark was the commercial incentive to find local alternatives to cinchona. Monopolies of trade required availability and cultivability of similar species of commercial commodities within areas of control. Another was scientific. The bark promised a cure for a major disease for Europeans in the colonies and the search for a substitute had become a global scientific obsession. For botanists like Roxburgh, who were based in India, the discovery of a cinchona substitute was one of the few ways of achieving international recognition. Moreover, the scientific ambiguity of the most suitable species of cinchona prompted the trial of many alternatives in different regions.

By focusing on the identification and scientific analyses of *Swietenia* and other similar substitutes, both in India and in England, this paper first investigates the trajectories of the search for medical alternatives in the empire through the burgeoning networks of trade and natural history. It then studies the other aspect of this process; an analytical contraction, whereby many such alternatives were chemically reduced to their active components in Europe. This addresses a historiographical issue; the need to re-emphasize the epistemological authority of Europe—and its scientific institutions—which emerged as the metropolis of science in this period. Over the last few decades, writings in the

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¹ Regarding the nomenclative variations of the febrifuge see, D J Mabberley, 'William Roxburgh's "Botanical description of a new species of *Swietenia* (mahogany)" and other overlooked binomials in 36 vascular plant families', *Taxon*, 1982, **31**: 65–73, pp. 65–8.

history of science have increasingly defined the periphery in terms of its diverse dynamism.² Such works have been informed to an extent by the emerging literature on imperialism which has highlighted the dynamic and regenerative aspects of colonial encounters, particularly of the eighteenth century, in an attempt to mark these local histories as important sites of global understanding.³ Historians of science have subsequently stressed the need to understand the creativity and vitality of colonial knowledge systems. They have asserted that modern science in colonial India was a product of the intercultural encounter between South Asians and Europeans.⁴ Others have located the roots of present global ecological concerns in the emergence of ecological thought from within colonial localities.⁵ However, reorienting the problematic of science from Europe to the colonies need not necessarily lead to a realignment of its intellectual capital. As this paper shows, the rejection of the alternatives to cinchona or the Peruvian bark was the result of the dominance of a metropolitan scientific method, which counteracted the diverse creativity of the periphery. Along with the searches for medical alternatives in the empire through the burgeoning networks of natural history, Europe had also undertaken various methods of analysis, particularly with the emergence of modern chemistry. This dynamic of the search for alternatives in the periphery and their analysis in the metropolis was crucial to the emergence of not only cinchona as a panacea but also of modern therapeutics.

From the seventeenth century, cinchona has occupied an important position in the European pharmacopeia. It has a fascinating history starting from its discovery by Europeans in South America, its uses and its transmission and distribution throughout Europe and other continents. In the eighteenth century, there was a frantic search for the true species of the tree that produced the Peruvian bark. Increased demand, rising prices and confusion over the identity of the tree made it essential to locate it in its native habitat. In 1735, the French government sent an expedition under Charles Marie de la Condamine to South America, ostensibly to measure the arc of the meridian at Quito in Ecuador to determine the diameter of the earth, but also to search for the fever tree. Condamine succeeded in finding the cinchona tree about 20 miles from Loxa, in Peru.⁶

There is another aspect to this history. The eighteenth century was a period of global search for alternatives. In therapeutic remedies this was particularly reflected in the

² See Mark Harrison, 'Science and the British empire', *Isis*, 2005, 96: 56–63; Roy MacLeod, 'On visiting the "moving metropolis": reflections on the architecture of imperial science', in Nathan Reingold and Marc Rothenberg (eds) *Scientific colonialism: a cross-cultural comparison*, Washington, DC, Smithsonian Institution Press, 1987, pp. 217–49.

³ C A Bayly, *Imperial meridian: the British empire and the world, 1780–1830*, London, Longman, 1989, p. 10. See also Phillip B Wagoner, 'Precolonial intellectuals and the production of colonial knowledge', *Comparative Studies in Society and History*, 2003, 45: 783–814, p. 783; Thomas Trautmann, 'Inventing the history of South India', in Daud Ali (ed.), *Invoking the past: the uses of history*

in South Asia, New Delhi, Oxford University Press, 1999, 36–54; Eugene F Irschick, *Dialogue and history: constructing South India, 1795–1895*, Berkeley, University of California Press, 1994.

⁴ Kapil Raj, *Relocating modern science: circulation and the construction of scientific knowledge in South Asia and Europe, seventeenth to nineteenth centuries*, Delhi, Permanent Black, 2006.

⁵ Richard H Grove, *Green imperialism: colonial expansion, tropical island Edens and the origins of environmentalism, 1660–1800*, Cambridge University Press, 1995.

⁶ M R Lee, 'Plants against malaria. Part 1: Cinchona or the Peruvian bark', *J. R. Coll. Physicians Edinb.*, 2002, 32: 189–96, pp. 191–2.

interest in substitutes for cinchona. For the British, with no colonial base in the South American continent, the imperative was to locate alternatives to cinchona in their own colonies. Several such plants were discovered by British surgeons in the West Indies. In St Lucia, George Davidson found trees very similar to the *Cinchona officinalis*.⁷ In Jamaica, William Wright, the Surgeon-General, discovered the *Cinchona caribaea*.⁸ Wright had also identified the plant which yielded the *Simaruba* bark (a native of northern Brazil, Guyana and some West Indian islands), and sent a drawing and a description of it to Dr Hope, professor of botany at Edinburgh.⁹ When he returned to Edinburgh, he carried with him what the *Medical and Philosophical Commentaries* described as a “large collection of natural curiosities”, among them specimens of the new species of Peruvian bark.¹⁰ The *Cinchona triflora* was discovered by Mr Roberts, a clergyman in Jamaica; while Mr Lindsay, a surgeon, came across the *Cinchona brachycarpa* in the parish of Westmoreland, Jamaica, in 1785.¹¹ Many such alternatives were also found in the Indian subcontinent. These discoveries involved interactions between indigenous practitioners, Jesuit missionaries and European surgeons and botanists, some of which will be discussed in the course of this paper.¹² In fact the literature produced in this period on the alternatives to cinchona was almost as extensive as that on cinchona itself.

While the search for cinchona has been well documented, along with the history of quinine, the history of alternatives to febrifuges has received little scholarly attention.¹³ The only account is an informative but brief article by Mark Harrison.¹⁴ Simultaneously, there has also been a trend to follow the history of cinchona in a teleological fashion, from the seventeenth century to its global propagation in the nineteenth. Saul Jarcho’s very interesting book *Quinine’s predecessor* focuses particularly on the history of cinchona, from the days of its discovery by Europeans. What has been left completely untraced is the history of the alternatives, and the question that remains to be asked is: how did the alternatives get lost?

⁷ George Davidson, communicated by Donald Monro, ‘An account of a new species of the bark-tree, found in the Island of St. Lucia’, *Phil. Trans. R. Soc. Lond.*, 1784, **74**: 452–6.

⁸ *A memoir of the late William Wright, with extracts from his correspondence, and a selection of his papers on medical and botanical subjects*, Edinburgh and London, William Blackwood, 1828, p. 199.

⁹ William Wright, *A botanical and medical account of the Quassia simaruba, or tree which produces the cortex simaruba*, Edinburgh, 1778.

¹⁰ ‘Medical News’, *Medical and Philosophical Commentaries*, 1778, **5**: 218.

¹¹ *A memoir of the late William Wright*, op. cit., note 8 above, p. 200.

¹² Mark Harrison, ‘The discovery of indigenous febrifuges in the British East Indies, c.1700–1820’, in

Merlin Willcox, Gerard Bodeker; Philippe Rasoanaivo; Jonathan Addae-Kyereme (eds), *Traditional medicinal plants and malaria*, Boca Raton, CRC Press, 2004, pp. 199–203.

¹³ Saul Jarcho, *Quinine’s predecessor: Francesco Torti and the early history of cinchona*, Baltimore, Johns Hopkins University Press, 1993; Donovan Williams, ‘Clements Robert Markham and the introduction of the Cinchona tree into British India’, *Geog. J.*, 1962, **128**: 431–42; Fiammetta Rocco, *The miraculous fever-tree: malaria, medicine and the cure that changed the world*, London, Harper Collins, 2003; M Honigsbaum, *The fever trail: in search of the cure for malaria*, New York, Farrar, Straus and Giroux, 2001.

¹⁴ Harrison, op. cit., note 12 above.

William Roxburgh and his Fever Bark

Roxburgh published a treatise on the newly discovered *Swietenia febrifuga* in 1793, with the aim of persuading the Court of Directors of the EEIC in London to promote its use as an alternative to the Peruvian bark.¹⁵ The treatise included an account of the detailed chemical researches that he had undertaken to establish the qualities of the bark. He had experimented with chalybeate, limewater, vitriolic acid, vinegar, mild or caustic vegetable alkali and magnesia and found that the antiseptic powers of this bark were directly proportional to its bitter and astringent virtues.¹⁶ Roxburgh's conclusions were that the active parts of the *Swietenia* were more soluble than those of the Peruvian bark, it contained a much larger proportion of the active (bitter and astringent) powers, and the watery preparation of the bark remained potent much longer than similar preparations of the Peruvian bark.¹⁷

Roxburgh's conclusions were drawn from outside the laboratory as well, from an Anglo-Danish-German network of surgeons and missionaries who carried out trials and experiments on the bark in the Madras presidency. Soon after its discovery in 1791, he sent samples of *Swietenia* bark to his trusted German-Danish missionary friend, the Reverend Christopher Samuel John, in Tranquebar, for trials in the local hospitals and by the mission surgeons. In 1792, John reported that he had given the bark to the mission doctors T L F Folly and J G Klein to try preparations from it on the patients in their hospital. He had also given it to a fellow missionary, Johan Peter Rottler, who had a strong interest in the natural history of the region, and had commented, "Your Bark *Swietenia Febrifuga* gets here the highest reputation by Dr Klein and Dr Folly." Rottler also asked for seeds of the tree, adding that the missionaries planned to send it to Copenhagen.¹⁸ In November 1792, John mentioned that eighty samples of the bark had been sent to Professors Winslow and Jade at Copenhagen, "both of high reputation".¹⁹ More news of success locally was forthcoming; with Roxburgh's bark, the surgeon at Tranquebar had cured Rottler who had almost died from intermittent fever.²⁰

Within the Madras medical establishment, Andrew Ross, an EEIC merchant based in Madras and a collaborator of Roxburgh in his botanical pursuits, helped to promote *Swietenia* bark among the surgeons in the town and elsewhere in the Presidency. He informed Roxburgh that William Duffin at the Madras hospital had found the substance useful, and promised to obtain a declaration from him, which he would then send to England.²¹

¹⁵ William Roxburgh, 'A botanical description of a new species of *Swietenia* (mahogany) with experiments and observations on the bark thereof, in order to determine and compare its powers with those of Peruvian Bark for which it is proposed as a substitute', addressed to the Honourable Court of Directors of the United East-India Company by their most obedient humble servant Wm Roxburgh, London, 1793. Two copies of this publication are held in the British Library.

¹⁶ *Ibid.*, p. 16. In the pre-quinine days astringency was considered to be the active principle of "fever barks".

¹⁷ *Ibid.*

¹⁸ *Ibid.*

¹⁹ Christopher S John to William Roxburgh, 26 Nov. 1792, British Library (hereafter BL), Asia, Pacific and Africa Collections (hereafter APAC), MSS. Eur D 809. John was probably referring to Frederik Christian Winslow, surgeon-in-chief to the Royal Frederic Hospital, Copenhagen. He was famous for his pioneering vaccination work in Denmark, see, E D V Gotfredsen, 'Some relations between British and Danish medicine in the seventeenth and eighteenth centuries', *J. Hist. Med. Allied Sci.*, 1953, 8: 46–55, p. 55.

²⁰ Christopher S John to William Roxburgh, 26 Nov. 1792, BL, APAC, MSS. Eur D 809.

²¹ Andrew Ross to William Roxburgh, 17 July 1792, Madras, Botany Library, Natural History

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Figure 1: *Swietenia febrifuga*, from William Roxburgh, *Plants of the coast of Coromandel ... published under the direction of Sir Joseph Banks*, London, George Nicol, 1795–1819, vol. 1, p. 17.

In early 1793, Ross discussed the new remedy with Charles Oakley (President of the Madras Council of the EEIC), who suggested that Roxburgh should approach the Madras Hospital Board, the Company's main medical regulatory authority of the Presidency, for its official endorsement.²² Roxburgh accordingly sent the bark to James Anderson

Museum, London (hereafter NHM), MSS ROX, 1793; Andrew Ross to Roxburgh, 6 Oct. 1791, Madras, NHM, MSS ROX, 1793.

²² Andrew Ross to William Roxburgh, 5 Jan. 1793, Madras, NHM, MSS ROX, 1793.

(Surgeon-General and President of the Board).²³ Additionally, Valentine Conolly, Secretary to the Hospital Board, forwarded the bark to the head surgeons of the provinces, William Raine, Terence Gahagan, George Binny and Nicol Mein, asking them to try it on patients in their local hospitals so that its “virtues may be more fully ascertained”, and to send the results to Madras.²⁴

Gahagan promised to try the bark.²⁵ Mein mentioned that his initial experiments suggested that the substance contained a higher degree of astringency than the Peruvian one.²⁶ Binny wrote back that he had already heard of the bark from Roxburgh and had tried it successfully in some cases.²⁷ In June 1793, Mein confirmed his success with *Swietenia*, “the cure of the Intermittent fevers corroborates Dr Roxburgh’s observations and I hope will prove satisfactory to the Physician General and the Members of the Hospital Board”.²⁸

Ross kept Roxburgh, who was still based in remote Samulcottah, informed about the progress of the experiments on the bark and the promise of doctors in Madras to promote its use: “Dr Berry has read your dissertation upon it & will also support it.”²⁹ But apparently impatient with the delay in receiving confirmation from the Company hospitals, Roxburgh seems to have suggested that Ross offer Dr Berry a share of any profits from sales of the bark, in return for a prompt acknowledgment. Ross restrained Roxburgh saying that such a step “would amount to an indirect acknowledgement that its [*Swietenia*’s] intrinsic [sic] quality, was not good enough . . . it would be a derogation to your character, to take any indirect course, of bringing it to any further test, which may be required, of public enquiry”.³⁰ He also kept his faith in Anderson and the Madras establishment, “and I have no reason to doubt, that the means which Dr Anderson is pursuing . . . of ascertaining the true character of the Bark—is not only in due form, but fair in intention”.³¹ These were some of the methods of ascertaining the efficacy of the bark through the acceptable means of gentlemanly science in the periphery. A few months later, Ross wrote to Roxburgh that Dr Mein of Trichinopoly had found it very useful.³²

The same year, 1793, Ross wrote to John Forbes (senior), partner of the major shipping company, Forbes & Co., in Bombay, asking him to arrange for trials of the bark in hospitals throughout the Bombay Presidency. This new substance, he stated enthusiastically, was believed to be as good as, if not better than, the Peruvian bark, and it had already met with success in Madras.³³ Ross stressed the great benefits to both commerce and medicine if such a product could be procured fresh in India. The greatest advantage would be “by its being the produce of the Company’s own estate instead of

²³ William Roxburgh to James Anderson and the Madras Hospital Board, 17 Feb. 1793, Surgeon General’s Records (hereafter SGR), Tamil Nadu State Archive, Chennai, vol. 9, p. 24.

²⁴ Valentine Conolly to Messrs. Raine, Gahagan, Binny, and Mein, 5 Mar. 1793, *ibid.*, p. 21.

²⁵ Terence Gahagan to Valentine Conolly, 10 March 1793, *ibid.*, p. 22.

²⁶ Nicol Mein to Valentine Conolly, 24 March 1793, *ibid.*, p. 28.

²⁷ George Binny to Valentine Conolly, 6 April 1793, *ibid.*, p. 32.

²⁸ Nicol Mein to Valentine Conolly, 4 June 1793, *ibid.*, p. 50.

²⁹ Andrew Ross to William Roxburgh, 26 Feb. 1793, NHM, MSS ROX, 1793.

³⁰ Andrew Ross to William Roxburgh, 21 Mar. 1793, NHM, MSS ROX, 1793.

³¹ *Ibid.*

³² Andrew Ross to William Roxburgh, 28 Sept. 1793, NHM, MSS ROX, 1793.

³³ Andrew Ross to John Forbes, 2 Nov. 1793, NHM, MSS ROX, 1793.

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the large imbursement of its value which is made to another nation".³⁴ Ross sent a good quantity of *Swietenia* bark to Forbes so that trials could be carried out in both the hospitals in the city of Bombay and the provinces, as had been done in Madras. He also mentioned that Roxburgh intended to test it in places like Constantinople, where intermittent fever was reported to be rampant and where there was a strong presence of European medical men. He hoped that this would be a way for it to become known among physicians in Europe as well. While approval from the Madras Board was important for local use of the bark, Europe was the prime site for *Swietenia*'s recognition. Ross asked Forbes to use his trading networks to send the bark to:

such nations within your reach where those complaints are most frequent to the cure of which that remedy is applied & to procure reports of its efficacy from the physical gentlemen who reside there . . . It can be sent forward to such parts to the Westward, through the Gulphs of Persia & Mocha & towards the Turkish Dominions where there are European Doctors & where it may be of most use . . .³⁵

Despite these local corroborations and acknowledgments, recognition from Europe had always been vital for Roxburgh and he tried to utilize his own networks to achieve this. In 1784, before his discovery of *Swietenia*, he had written to Joseph Banks from Samulcottah about the several substitutes for Peruvian bark that he had found in India. One of them was the bark of *Melia azadirachta*,³⁶ and he found it worked "wonderfully well". He sent the bark and some fresh leaves to Banks. There was also the root of *Archipecus vomitoria* discovered by Johann Gerhard Koenig. British officers who had been prisoners of Hyder Ali for a long time told Koenig that when indisposed they used the dried roots of this plant both as an eructic as well as a cathartic. They made it up into pills of a few grains each and took one every half or three quarters of an hour. Roxburgh also sent Banks samples of the *Clitoria ternata*, whose roots were used in purgation.³⁷ In 1791, he sent him a package of *Swietenia* bark and asked him to pass on a parcel to his friend, Patrick Russell.³⁸ Roxburgh wanted his discovery of the bark to be known in English medical circles and his treatise on it to be published in the *Philosophical Transactions* of the Royal Society.³⁹

Roxburgh also corresponded about his new bark with James Edward Smith, founder and first president of the Linnean Society of London. In 1792 he sent Smith the "fever bark"

³⁴ Ibid.

³⁵ Ross to John Forbes, 6 Nov. 1793, NHM, MSS ROX, 1793.

³⁶ The *Neem* tree, which has been widely used in Indian medicine.

³⁷ William Roxburgh to Joseph Banks, 10 Dec. 1784, Banks Correspondence, BL, Add. MS 33977, fols 272–3.

³⁸ William Roxburgh to Joseph Banks, 10 Dec. 1791, Banks correspondence, BL Add. MS 33979, fols 116–17.

³⁹ Banks had replied that since it had already been printed the Royal Society would not be willing to republish it: "You mention in one of your letters an intention that the paper on *Swietenia* should appear in the *Philosophical Transactions*, whether the Commee

[sic] of papers who regulate the publications of the R. Soc. would or would not have admitted it was never put to the test for the Court of Directors published it the moment it came to their hands so that the first copy I saw was a printed one"; Joseph Banks to William Roxburgh, 29 May 1796, Banks correspondence, BL Add. MS 33980, fol. 66. Roxburgh's account did, however, appear in *Medical Facts and Observations*, 'An account of a new species of *Swietenia* (mahogany); and of experiments and observations on its bark, made with a view to ascertain its powers, and to compare them with those of Peruvian Bark, for which it is proposed as a substitute', *Medical Facts and Observations*, 1795, 6: 127–61.

through William Farquhar.⁴⁰ In March 1793, Roxburgh wrote to him again about the success of the bark in India, “It gives me particular pleasure to observe to you that the new Swietenia bark continues to support to the utmost of my wishes, the character I first gave it, seldom or never failing to perform speedy cures in all kinds of Remitting and Intermittent fevers, even after the Peruvian bark had faild [*sic*]”. He added that the Coromandel coast was particularly suited for such experiments as it “had abundance of cases to try it in”.⁴¹ After his appointment as superintendent of the Calcutta botanical garden, Roxburgh continued to correspond with Smith. In 1794 he wrote, “I hope [the Swietenia bark] proves of equal benefit in Europe. It has answered so well with the Batavia Fever, that the physician general there applied for and got 1000 pounds of it a few weeks ago.”⁴²

What were the scientific virtues of the bark that Roxburgh sought to promote in Europe? Andreas-Holger Maehle has suggested that a shift took place in eighteenth-century ideas of “specifics” when a remedy was no longer defined through its single target, such as intermittent fever, but through its uniquely powerful and not fully understood mode of action, which was beneficial in a number of diseases.⁴³ Roxburgh promoted Swietenia in Europe, keeping in mind the changing values, and claimed its usefulness not only for malarial fevers, but also for gangrene and other putrid maladies. He conferred with William Cullen of Edinburgh University, who had described the recurrence of paroxysms in terms of “atony”⁴⁴ in the extremities of the arterial system and advocated the use of simple bitters as the means to treat it. Taking these viewpoints into consideration, Roxburgh concluded that “from the successful experience I have had with [this new bark], in intermittent fevers, &c. I have every reason to imagine it will prove equal, if not superior, to the Peruvian bark, for every purpose where that medicine is used”.⁴⁵ In the same paper, Roxburgh also mentioned several plants and roots found in India, “perfectly unknown to European botanists” that the “poor natives” of the mountainous parts of the coastline consumed for their nutritional value.⁴⁶

Despite the participation in such contemporary discourses, however, scientific recognition in England for the discoveries made in the colonies was not easily forthcoming, often because of a lack of patronage. The EEIC did little to promote the scientific work of its servants. In 1791, Roxburgh complained to the Madras government about the failure of the Court of Directors to promote and promulgate “useful discoveries made by their own official Servants, and in their own territories”.⁴⁷ Roxburgh also felt aggrieved by the actions of some individuals based in London, like Alexander Dalrymple (FRS and hydrographer to the Company and the Royal Navy), who tended to appropriate the credit for researches done elsewhere. In a note Roxburgh accused Dalrymple of

⁴⁰ William Roxburgh to James E Smith, 4 Aug. 1792, 182, J E Smith Manuscripts, Linnean Society Library, London (hereafter Linnean).

⁴¹ William Roxburgh to James E Smith, 20 June, 1793, 8.184, J E Smith Manuscripts, Linnean.

⁴² William Roxburgh to James E Smith, 14 Jan. 1794, 8.188, J E Smith Manuscripts, Linnean.

⁴³ Andreas-Holger Maehle, *Drugs on trial: experimental pharmacology and therapeutic innovation in the eighteenth century*, *Clio Medica*, vol. 53, Amsterdam, Rodopi, 1999, pp. 287–8.

⁴⁴ Want of tone: enervation, languor.

⁴⁵ Roxburgh, op. cit., note 15 above, p. 18.

⁴⁶ *Ibid.*, p. 24.

⁴⁷ William Roxburgh to the Madras Government, 30 Aug. 1791, MSS. Eur F.18 (I) K148, APAC. For a detailed analysis of problems of metropolitan recognition for peripheral scientists, see P Chakrabarti, *Western science in modern India, metropolitan methods, colonial practices*, New Delhi, Permanent Black, 2004, pp. 60–93.

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publishing material from his (Roxburgh's) collections without asking permission. Roxburgh had sent Dalrymple a paper on *Swietenia* together with a letter addressed to the Court of Directors, and Dalrymple had appropriated some of Roxburgh's comments in his own publications, without proper acknowledgment.⁴⁸

Roxburgh faced other professional constraints. When Banks finally replied in 1796 about the potential of the new bark in England, he was rather pessimistic about its acceptance there, not because of its scientific value, but for professional reasons. Banks commented candidly and rather critically on physicians in England and their lack of enthusiasm for "new" knowledge,

I rejoice to hear that your *Swietenia* Bark gains credit in India. Here it's scarce possible for a new medicine to gain a place in the Dispensary. Physicians here who gain more in a week probably than they deserve in a year care not how few medicines their *Materia Medica* is composed of, the fewer their number the less expense of thought in making use of them.⁴⁹

In addition to this, investigation into alternatives to cinchona was a highly competitive field in contemporary England. Banks himself was engaged in its study. Aylmer Bourke Lambert published his *Description of the genus Cinchona* in 1797, which he dedicated to Banks with the words, "by whose liberal and Friendly communications accompanied by Original Drawings and Specimens from His Herbarium this work has been so Amply Enriched".⁵⁰ Lambert was a British botanist who assembled an important herbarium and library which were sold after his death. His major work was *A description of the genus Pinus*. Both Banks and Smith, Roxburgh's two contacts in England, were important advisers to this scholarly publication.⁵¹

Banks's scepticism about the acceptance of new medicine in England was significant. Although he and others had built a global network of natural history and accumulated a large number of specimens, he was aware that interest in them in Europe, and therefore the likelihood of their acceptance, was declining. This intellectual conservatism is a critical factor in the history of alternatives.

Swietenia and the Cinchona Substitutes

Even in India, *Swietenia* was just one of the many substitutes for the Peruvian bark found by colonial medical men. Such finds were the product of a wide intellectual and cultural enterprise undertaken in different parts of the country. There was, for instance, the *Caesalpinia bonducella*, more popularly known as *Catcaranja*. John Fleming, another

⁴⁸ *Ibid.*, p. 244. Roxburgh's aspersions about Dalrymple perhaps had some grounds. A socially ambitious man, Dalrymple, after a career in the colonies, had by this time established his position in London. He was a close friend of Joseph Banks and a regular member of the Royal Society club, dining weekly under Banks's chairmanship. Andrew S Cook, 'Dalrymple, Alexander (1737–1808)', *Oxford Dictionary of National Biography*, <http://www.oxforddnb.com/view/article/7044>, accessed 4 Aug 2005.

⁴⁹ Joseph Banks to Andrew Roxburgh, 29 May 1796, Banks correspondence, BL Add. MS 33980, fol. 65.

⁵⁰ A B Lambert, *A description of the genus Cinchona ... illustrated by figures of all the species hitherto discovered. To which is prefixed Professor Vahl's dissertation on this genus ... Also a description accompanied by figures of a new genus named hyænanche, or, hyæna poison*, London, B & J White, 1797, title-page.

⁵¹ Banks correspondence, BL Add. MS 33980, fols 121–4.

EEIC surgeon, wrote in his 'Catalogue of Indian medicinal plants' that although it was found in both the East and the West Indies, its medicinal values were appreciated only in the East, particularly its bitter tonic qualities. Here it was "employed by the Hindu physicians, in all cases in which that power is more especially required; and particularly in intermittent fevers, for which they are considered as an almost infallible remedy".⁵² He added,

It has been adopted by many European practitioners, particularly in those cases which so frequently occur, in which the patients have an aversion to the Peruvian bark . . . In all such cases, and also on occasions where the Peruvian bark cannot be procured, I believe that the *Catcaranja* will be found one of the best substitutes to which we can have recourse.⁵³

Another substitute was *Menispermum cordifolium / verrucosum*, also referred to by Heinrich van Rheede as *Cit-amerdu*.⁵⁴ Fleming stated that Hindu physicians prescribed the decoction of the leaves as a febrifuge as well as a cure for jaundice.⁵⁵ In Sylhet, Bengal, a species of *Hymenodictyon* was found, which, according to the surgeon J Forbes Royle, "affords a set of interesting facts, as these are all nearly allied to the valuable medicinal genus *Cinchona*".⁵⁶

Another substitute for cinchona was found by John Kennedy, surgeon to the third battalion of native infantry. In a letter to the Edinburgh based physician, Andrew Duncan (junior) in 1795, Kennedy gave an account of a febrifuge bark that he had found in Chunar (40 km from Varanasi, Uttar Pradesh). He had earlier met Roxburgh at Samulcottah and collected the *Swietenia* bark and found it useful in a number of cases. But being posted at Chunar Garh, "far distant from the source of supply [of the *Swietenia* bark]" he started looking for local substitutes and experimented with the bark of the "toon-tree" (*Cedrela toona*), and discovered that "it possessed qualities approximating to Dr Roxburgh's bark". He then used it widely in his medical practice both in the form of powder and of extract in their simple state, "From all these different forms, I have found great advantage in the cure of fevers, and of different kind of ulcers, whether venereal or of the simple vitiated kind."⁵⁷ Kennedy found it to be particularly useful when used with *Catcaranja*. He sent a sample of the bark, some extracts, as well as some of the *Catcaranja* to Duncan. He also enclosed a letter from Roxburgh recognizing the virtue of the "Toon bark".⁵⁸ Roxburgh later found the toon tree in plenty in the botanical garden at Calcutta and acknowledged that it was "possessed of sensible qualities nearly equal to mine".⁵⁹ Kennedy ended his piece expressing his hope of its success in Europe, "the toon-tree-bark, upon its trial in Europe, may correspond with the account I have given of its medical virtues".⁶⁰

⁵² J Fleming, 'A catalogue of the Indian medicinal plants and drugs', *Asiatick Researches*, 1812, 11: 153-96, p. 160.

⁵³ *Ibid.*

⁵⁴ Heinrich van Rheede, *Hortus Indicus Malabaricus*, 12 vols, Amsterdam, 1678, vol. 7, p. 39.

⁵⁵ Fleming, *op. cit.*, note 52 above, p. 171.

⁵⁶ J Forbes Royle, *Illustrations of the botany and other branches of the natural history of the Himalayan Mountains, and of the flora of Cashmere*, 2 vols, London, Wm H Allen, 1839, p. 238.

⁵⁷ Letter, 25 Apr. 1795, *Annals of Medicine*, 1796, 1: 387-8.

⁵⁸ Also mentioned by William Jones, 'Botanical observations on select Indian plants', *Asiatick Researches*, 1795, 4: 237-312, p. 273.

⁵⁹ Letter from Andrew Roxburgh to the Editor, 10 August 1794, *Annals of Medicine*, 1796, 1: 390.

⁶⁰ *Ibid.*, p. 391.

Swietenia febrifuga and the Cinchona Substitutes

There is some confusion regarding the botanical and ethnological roots of the *Swietenia*. Roxburgh claimed to have collected the species from the forests of the Rajahmundry region, in present Andhra Pradesh. He did not specify how he became aware of the medical virtues of the bark or whether local people used it for medicinal purposes. There is some evidence that it was customarily used as a medicine. Forbes mentioned that *Soymida* was traditionally “reckoned a good stomachic and powerful febrifuge”, and the bark of *Cedrela toona*, a congener, as well as that of *Chikrassee* was used as an astringent.⁶¹ In John A Parrotta’s *Healing plants of peninsular India*, the *Soymida* is described as “a popular drug in traditional Indian medicine, and is credited with antiperiodic properties”. It was used in the treatment of diarrhoea, dysentery, and intermittent fevers.⁶²

Similar confusion existed regarding the celebrated cinchona bark as well, which shows how the history of febrifuge barks was closely linked with the intellectual and material interests of colonialism. The barks held an important clue to European imperial interests in the tropics and their proprietorship was thus intensely contested. There was uncertainty regarding both the species from which the cinchona bark was taken and the origins of its use in intermittent fevers. It was in the seventeenth century that a monk of the Augustinian order became aware of its medicinal qualities, having apparently been informed by the locals, as he noted, “A tree grows which *they* call ‘the fever tree’ in the country of Loxa”.⁶³ A piece published in the *Philosophical Transactions* in 1737 by John Gray also confirmed this view. According to him, William Arrot, a Scottish surgeon who collected the bark from Peru commented that “its Qualities and Use were known to the Indians before ever any *Spaniard* came among them; and that it was by them applied in the Cure of intermittent Fevers, which are frequent over all that wet and unhealthy country”.⁶⁴

However, according to the British geographer and “adventurer” Clements R Markham, who secretly collected the seedlings from Peru, deceiving the local inhabitants and authorities, and then propagated it in the Empire,⁶⁵ its medicinal virtues were, if at all, known only around Loxa, and even there the indigenous people “attached little importance to them”.⁶⁶ Inhabitants of other areas like the province of Huanuco had “a strong repugnance to its use”. According to Markham this could be explained by their understanding of diseases in terms of heat or cold, and they believed the bark to be very effective in inducing heat, which also explained, in his opinion, “their prejudice against its use

⁶¹ Royle, op. cit., note 56 above, p. 143.

⁶² John A Parrotta, *Healing plants of peninsular India*, Wallingford, NY, CABI Publishing, 2001, p. 501. He also says that the bark forms the Ayurvedic drug Mamsarohini, used to promote blood coagulation, and to treat oedema, wounds, dental diseases, uterine bleeding, diarrhoea, dysentery, haemorrhage and malarial fever, p. 502.

⁶³ Quoted in Marie Louise de Ayala Duran-Reynals, *The fever bark tree: the pageant of quinine*, Garden City, NY, Doubleday, 1946, p. 24. Emphasis mine.

⁶⁴ ‘An account of the Peruvian or Jesuits bark, by Mr. John Gray, F. R. S. Now at Cartagena in the Spanish West-Indies; extracted from some papers given him by Mr. William Arrot, a Scotch Surgeon, who had gather’d it at the place where it grows in Peru. Communicated by Phil. Miller’, F.R.S. &c., *Phil. Trans. R. Soc. Lond.*, 1737, 40: 81–6, p. 86.

⁶⁵ Williams, op. cit., note 13 above, p. 435.

⁶⁶ Clements R Markham, *Peruvian Bark: a popular account of the introduction of Chinchona cultivation into British India, 1860–1880*, London, John Murray, 1880, p. 6.

in fevers”.⁶⁷ It has also been debated whether malaria, in the treatment of which cinchona was found to be revolutionary, existed in the New World before the advent of the Spanish. Markham put forward the argument that the disease was not to be found in the pre-Columbian Americas and also that the bark was absent in the materia medica of the Incas.⁶⁸ But Duran-Reynals suggests that in the several years between the arrival of the Spanish, who supposedly brought malaria to these parts, and the European discovery of cinchona, the inhabitants of the forests might have independently developed the cure for the disease. There is evidence to show that a great degree of interaction took place between local healers, their curative plants and treatments, and the Europeans during this period.⁶⁹

Until the nineteenth century, the species *Cinchona* itself was perplexing. As another Madras-based EEIC surgeon, Whitelaw Ainslie, commented, “The genus cinchona, of which twenty-four species have been described, Mr. Thomas, with much truth, observes is still involved in considerable ambiguity.”⁷⁰ He also mentioned that similar plants were found in Siam (Thailand). Ainslie pointed out the general problems encountered in identifying such medicines and plants from Eastern markets, “the imperfect condition in which a great many of the medicines are found in the bazaars; old, dry, and not seldom decayed. I have frequently been obliged to take on trust a description of their characterizing taste and smell; at other times, the root, or bark, or leaf, called for, was not to be found”.⁷¹ Forbes Royle discussed the problem of identifying the true medicinal species of distant lands:

Though the extent and distribution of the true *Cinchonas* has been pretty well ascertained, there is yet considerable obscurity respecting the species which yield the different official barks, owing partly to incomplete investigation, but chiefly to the natives uniting them according to physical properties, which vary even upon the same tree, according to age and exposure . . .⁷²

In Britain, similar confusion remained as Andrew Duncan (junior) indicated, “Notwithstanding that all the British colleges agree in the botanical species of *Cinchona*, from which the commercial varieties of bark are derived, there is no satisfactory evidence that they are right; on the contrary, it is almost certain that in regard to some of them they are wrong.”⁷³

Another problem was the identification of the “true” species that produced the best cinchona bark. The genus *Cinchona* included over thirty species, which grew in scattered clumps in the forests of Colombia, Ecuador, Peru and Bolivia, each varying widely in terms of colour and alkaloids.⁷⁴ Such confusion about the origins and therapeutic value of the tree provided botanists like Roxburgh and Wright with the opportunity to look for local alternatives in the British colonies. Many of these barks were subjected to trials to clarify their origin and therapeutic value.

⁶⁷ Ibid., p. 7.

⁶⁸ Ibid., p. 5. For similar views, see Norman Taylor, *Cinchona in Java: the story of quinine*, New York, Greenberg, 1945, p. 29.

⁶⁹ Duran-Reynals, op. cit., note 63 above, pp. 25–6.

⁷⁰ Whitelaw Ainslie, *Materia Indica*, London, 1826, p. 126.

⁷¹ Ibid., p. xxxvi.

⁷² Royle, op. cit., note 56 above, p. 240.

⁷³ Andrew Duncan, *Supplement to the Edinburgh new dispensatory*, Edinburgh, Bell & Bradfute, 1829, p. 37.

⁷⁴ Lucile H Brockway, *Science and colonial expansion: the role of the British royal botanic gardens*, New York, Academic Press, 1979, p. 108.

The Trials of Swietenia

The next episode of the *Swietenia* story concerns its trials in Europe. John Fleming noted its success in hospitals in Britain, where it was “considered as a valuable substitute, in many cases of the *cinchona*”. Additionally, the Edinburgh College included it in their pharmacopoeia.⁷⁵ However, Roxburgh’s bark never, in fact, gained acceptance in Europe, although Andrew Duncan (senior) seems to have tried it in his infirmary in Edinburgh with some success.⁷⁶ Personal ambitions and commercial pressures played an important role in these European trials, and there was also a bias for locally developed astringents. Johannes Fawcett in Edinburgh (who wrote the *Dissertatio medica inauguralis de febris intermittentibus medendis*, 1798), advocated a combination of the astringent *bistorta* and the bitter *calamus aromaticus* in *Swietenia*’s place. He claimed this had been successful in “almost a hundred cases” of intermittent fever in Horncastle Hospital, Lincoln, and was even better than the yellow bark.⁷⁷

The main factor in the lack of proper scientific recognition in Europe for these different specimens was their unfamiliarity and their physical state when they reached Europe. The transfer of seeds, living plants, insects and animals across the oceans to England involved several hazards. Sea captains were not careful about their scientific cargo; plants died in the holds for lack of sunshine, and dried specimens were mixed up.⁷⁸ In 1730, Dr James Douglass described the problems of studying these plants in England, “as these Roots are never imported to us entire, it is impossible to give any certain Description of them in that State”.⁷⁹ Hans Sloane commented on how difficult it was to identify barks in London, particularly those coming from distant countries. Henry Barham, the Jamaica-based physician, had sent him a variety of the *Apocynum erectum*, commonly called Blood Flower in Jamaica (for its use in stopping blood, “when other medicines fail’d”). The plant was eminently useful according to Barham; the juice injected by a syringe stopped the bleeding of piles; a decoction of the leaves, stalks and flowers cured running gonorrhoea. The same root had been sent to Sloane, many years previously, from Virginia so that “a commerce [be] established for it”. But “not knowing what mischief might ensue from the Use of an unknown Root” he had disposed of it.⁸⁰ Dr Burnet, who was sent by the South Sea Company to take care of their factory at Port Belo, had sent him a draught of the same *Apocynum* and an account of how the Spanish and other inhabitants used that root instead of ipecacuanha. This was followed by Barham’s despatch of the same species. Still uncertain about its medical virtues, Sloane now referred it to the College of Physicians and the Company of Apothecaries. He also showed them the various specimens that he had received and the differences between this species and the true ipecacuanha. After observing the physical differences

⁷⁵ John Fleming, *A catalogue of Indian medicinal plants and drugs, with their names in the Hindustani and Sanskrit languages*, Calcutta, Hindustani Press, 1810, p. 39.

⁷⁶ Maehle, *op. cit.*, note 43 above, p. 281.

⁷⁷ *Ibid.*, p. 281.

⁷⁸ Bonnie S Stadelman, ‘Flora and fauna versus mice and mold’, *William and Mary Quarterly*, 1971, 28: 595-606. Teresa Huguet-Termes, ‘New World

materia medica in Spanish Renaissance medicine’, *Med. Hist.*, 2001, 45: 359–75.

⁷⁹ Dr Douglass, ‘A short account of the different kinds of ipecacuanha’, *Phil. Trans. R. Soc. Lond.*, 1729, 36: 152–8, p. 152.

⁸⁰ Hans Sloane, *A voyage to the islands Madera, Barbados, Nieves, S. Christophers and Jamaica*, 2 vols, London, 1707–25, vol. 1, p. xii.

between the varieties, the Company of Apothecaries chose “to condemn and destroy such a dangerous root”, which led to Sloane’s rejecting it as well, adding, “there is wide difference between fresh roots and those dried and that often one is not sure whether one has picked the right one”. Since many unknown roots were indeed very poisonous he was reluctant to be “the first Experimenter of such a Matter, either upon myself or anybody else”.⁸¹ According to him, the “Gumm Guajacum” of the West Indies, if not collected properly could also be poisonous.⁸²

Another instance of the confusion surrounding medical specimens sent from the colonies related to the cabbage tree bark. William Wright and others in Jamaica had learnt from the slaves about the use of the bark for curing worms. Wright had sent specimens to Edinburgh and the cabbage tree bark was used as an anthelmintic by several practitioners there. However, they complained of the “violence of its operation”, both as an emetic and a cathartic.⁸³ As a result, Edinburgh physicians did not think that “it will ever be soon introduced into common use”.⁸⁴ In a letter to Andrew Duncan (senior), William Anderson, who had worked in the West Indies as a surgeon, defended this bark, describing his own experiments with it, and highlighting the problems of researches done in England on specimens from distant lands:

I think it would be unfortunate, were it rejected without a fair trial. The hazardous symptoms which have been ascribed to it may, I imagine, have followed either from the use of the first kind [a paler variety which is not effective], or from an over dose. Both the one, and the other of these circumstances, however, might easily be guarded against . . . I must observe that I never saw it act violently when thus managed; while, at the same time, I have often experienced the best effects from it as a powerful anthelmintic [*sic*].⁸⁵

Wright too observed that although doctors in Edinburgh found that the bark of the cabbage tree caused nausea, this was never the case in Jamaica, and was probably due to the “mouldy state” of the specimens after the long voyage.⁸⁶

The same applied to *Swietenia*. Andrew Duncan (junior) based his dissertation on *Swietenia* bark on the samples sent to Edinburgh by Roxburgh. He, however, never saw the bark in its original form and depended on Roxburgh’s descriptions of it.⁸⁷ Later in his *Edinburgh new dispensatory* he wrote that that the *Swietenia* barks he had with him were in such a condition that they could not be distinguished from the “kino of the shops”.⁸⁸

By the end of the eighteenth century, however, developments in science were to resolve many of these problems of ambiguity as well as of the enmeshed ethnologies of these plants. Maehle has argued that the increasing reliance upon contemporary pharmacological explanations by European practitioners “eroded” cinchona’s status as

⁸¹ *Ibid.*, p. xii.

⁸² *Ibid.*, p. xii.

⁸³ ‘Medical News’, *Medical and Philosophical Commentaries*, 1773, 1: 328.

⁸⁴ Introduction to William Anderson, ‘Observations on the use of the cabbage-tree bark, as an anthelmintic’, *Medical and Philosophical Commentaries*, 1776, 4: 84–8, p. 84.

⁸⁵ *Ibid.*, pp. 86–7.

⁸⁶ William Wright, ‘Description and use of the cabbage-bark tree of Jamaica’, communicated by

Richard Brocklesby, *Phil. Trans. R. Soc. Lond.*, 1777, 67: 507–12, p. 511.

⁸⁷ Andrew Duncan, *Tentamen inaugurale, de Swietenia soymida: quam . . . pro gradu doctoratus, eruditorum examini subjicit Andreas Duncan*, Edinburgh, Balfour and Smellie, 1794, p. 2.

⁸⁸ Andrew Duncan, *The Edinburgh new dispensatory*, Edinburgh, 1829, p. 356.

a “specific” against intermittent fever, leading instead to its recommended use against a broader array of diseases including gangrene, ulcers, and smallpox. Its efficacy in treating both internally and externally manifest diseases allowed cinchona to become a central therapeutic agent for both physicians and surgeons.⁸⁹ However, this explanation for the emergence of cinchona as a panacea is inadequate. As discussed above, many of its substitutes also demonstrated a similarly broad therapeutic value. The pre-eminence of cinchona, as we shall see, was achieved by a general process of sifting which had evolved in European science, through which the entire problematic of medical alternatives was being resolved.

Cinchona and the Search for the “Active Principle”

The search for the “active principle” is where the fulcrum of this history is located. As the use of cinchona spread throughout Europe, apothecaries and chemists began to question which specific substance contained in the Peruvian bark and its substitutes was active against intermittent fevers. Sustained efforts were, therefore, made around 1800, to identify the “active principle” of the bark. In his *Dispensatory*, Duncan (junior), for example, expressed a desire to reveal the true essence of cinchona, “the preparation of an extract of cinchona, which may contain its active principles in a concentrated form, is a desirable object”.⁹⁰ The identification of an active principle was important, first, to reduce dependency on unscrupulous traders who often provided fake samples; second, as even the real bark varied in potency, extracting the active agent could also standardize the dosage. Armand Seguin, in his ‘Memoir on the febrifuge principle of cinchona’, made the rationale of the project clear, the uncertainties of *taste* and *smell* of the medicines of distant lands were to be distilled by chemistry:

Hitherto the sight and taste have been the only tests of the presumable qualities of the Peruvian bark of the shops; but as these have no precise standard, and are inapplicable to powdered bark,

⁸⁹ Maehle, op. cit., note 43 above, p. 258.

⁹⁰ Duncan, op. cit., note 88 above. Duncan (junior) was deeply influenced by the knowledge of chemistry emerging in the Continent. In his *Edinburgh new dispensatory* (1803), he focused particularly on the chemical doctrines and new nomenclature introduced by Antoine Lavoisier. As he discussed in its Preface, the period between the 1789 edition of the *Dispensatory* and his own, had witnessed great developments in chemistry, pharmacy, and natural history which necessitated a new compilation, “so as to render a complete reform absolutely necessary. This, to the best of my abilities, I have attempted” (p. vi). This had faced opposition elsewhere in England, but such a process was vital because, “Materia Medica and Pharmacy are but an application of Natural History and Chemistry” (p. viii). This combination of natural history and chemistry essentially characterized Duncan (junior)’s *Dispensatory*, and his analysis of the flood of medicobotanical information arriving from various parts of

the empire. So, although drawing mainly on the traditions of colonial botanical and linguistic studies, Duncan closely followed Lavoisier’s work on the need for a new *language* of chemistry as discussed in his treatise: *Traité élémentaire de chimie, présenté dans un ordre nouveau et d’après les découvertes modernes*, Paris, Cuchet, 1789; *Elements of chemistry*, translation by Robert Kerr, Edinburgh, William Creech, 1790, Dover facsimile edition, 1965, pp. xiii–xxxvii. Duncan talked of new names given to the various medical materials arriving from the different parts of the world according to the essential chemical component of substances and urged that “it naturally follows, that the names of all substances employed in medicine should be the same with the names of the same substances, according to the most approved systems of Natural History and Chemistry; and that the titles of compound bodies should express as accurately as possible the nature of their composition” (p. viii).

they very imperfectly indicate the presence of the febrifuge principle. It was of importance, therefore, to substitute to these means, little better than illusory, others not only capable of calculation, but likewise invariable. Chemical re-agents alone can answer these ends.⁹¹

This was part of a greater change in eighteenth-century science, sometimes referred to as the “Chemical Revolution”, initiated by Antoine Lavoisier in France. Lavoisier developed a new chemical taxonomy as well as a radically new understanding of all elements and compounds. Through these new modes, experimental chemistry had become a prime gentlemanly pursuit in eighteenth-century Europe. This new approach also shaped the public culture around science,⁹² and, additionally, developments in medical knowledge.

In 1779, the French chemists J B M Bucquet and C M Cornette announced that they had successfully extracted the “essential salt” of cinchona.⁹³ In 1790, another French chemist, Antoine François Fourcroy, discovered the existence of a “colouring” matter (a resinous substance with the characteristic colour of the bark) and for some time maintained that he had isolated the active principle.⁹⁴ Seguin had come to the conclusion that the active principle in cinchona was gelatine.⁹⁵ Duncan (junior), who had entered the field of astringent barks with his doctoral dissertation,⁹⁶ wrote a letter to Nicholson’s journal rejecting Seguin’s claims and maintaining that he was the first to suggest that a real substance existed as a febrifuge principle.⁹⁷ Duncan’s letter stressed that the presence of gelatine in cinchona was incompatible with his own experiments and conjectured that Seguin’s sample of the bark was probably adulterated. He proposed that the essential principle in cinchona was different from any hitherto described and that it be distinguished “by the title of Cinchonin”.⁹⁸ *Cinchonin* was an alkaloid (C₁₉H₂₂N₂O) that Duncan derived from the bark of various cinchona trees for use as a febrifugal agent. Duncan also admitted that while his experiments showed that *cinchonin* was different from gelatine, it was not necessarily the essential febrifuge principle, which would be investigated in future experiments, “Experiments alone, however, can ascertain the point, as well as whether the febrifuge effects of cinchona depend upon the cinchonin alone, or upon the peculiar combination of principles which exist in it.”⁹⁹ Yet, *cinchonin* seemed to hold some clues in identifying the essential principle of many confusing anti-malarial astringents, as well as ipecacuanha, columba, and angustura.¹⁰⁰ Accordingly, Duncan suggested determining the *cinchonin* content of different barks to assess their quality. In the *Swietenia* bark, he did not find any *cinchonin* in 1803.¹⁰¹

The next phase of development began some thirteen years later. According to Markham, it was Dr Gomez, a surgeon in the Portuguese navy, who was the first to isolate the active principle and “he called it *chinchonine*”.¹⁰² This seems initially to have

⁹¹ ‘Abstract of a memoir on the febrifuge principle of cinchona, by Cit. Seguin’, *Annals of Medicine*, 1803, 8: 240–1.

⁹² Jan Golinski, *Science as public culture: chemistry and Enlightenment in Britain, 1760–1820*, Cambridge University Press, 1992, pp. 112–28.

⁹³ Markham, op. cit., note 66 above, pp. 30–1.

⁹⁴ Ibid., pp. 31.

⁹⁵ Steven Lehrer, *Explorers of the body*, Garden City, NY, Doubleday, 1979, p. 185.

⁹⁶ Duncan, op. cit., note 87 above.

⁹⁷ Duncan, ‘Containing experiments and observations on cinchona, tending particularly to shew that it does not contain gelatine, to Mr. Nicholson’, *Journal of Natural Philosophy, Chemistry and the Arts*, 1803, 6: 226.

⁹⁸ Ibid., p. 226.

⁹⁹ Ibid., p. 228.

¹⁰⁰ Ibid.

¹⁰¹ Duncan, op. cit., note 88 above, p. 356.

¹⁰² Markham, op. cit., note 66 above, pp. 31.

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been the general assumption, as Duncan (junior) later took pains to establish that it was he who was the first to discover the essential principle of cinchona bark.¹⁰³ In 1820, the French chemists P J Pelletier and J B Caventou finally discovered that the febrifuge principle was actually present in two alkaloids, called *quinine* and *cinchonine*, with the same virtues, but much more powerfully in *quinine*.¹⁰⁴ Writing on this in 1829, Duncan commented that Pelletier and Caventou's discovery of *quinia* and the salts formed by acids with both bases "completed our knowledge of the *essential* principles of cinchona bark". But he was careful to point out that his claim as the "first discoverer of the essential principle of cinchona bark is now fully admitted by the French chemists", although "it was long erroneously ascribed to Gomes [*sic*]".¹⁰⁵ *Cinchonin* never became an antidote for malarial fever.

A similar solution to the problem of diverse forms of ipecacuanha was provided by the search for its active principle. Following the studies by Dr Ralph Irving (1784), M Henry and M Masson-Four, it was again Pelletier in 1822 who identified *emetine* in which it was believed "the active virtue of ipecacuanha exclusively resides", thus resolving the confusion.¹⁰⁶

The most significant result of the advances in the chemical knowledge of cinchona was that the search for alternatives became almost obsolete. *Swietenia* was not the only bark or remedy to be thus discarded, but its fate is illustrative of those found in the colonies, tested through local means and networks, and which were, for a time, considered to be important cures. Yet they dropped out of the scientific reckoning with changing paradigms. Thus with the shift to the chemical search for the "active principle", the quest for alternatives for the cinchona bark became almost irrelevant. The new research into the "active principle" never materialized in colonial scientific activities. Scientists in the colonies continued to look for alternatives at a time when those in Europe had made the breakthrough, and thus a hierarchy and monopoly around the Peruvian bark had been created. The year following Caventou's discovery of *quinine*, the *Medical and Chirurgical Transactions* published a long article by P Breton, assistant surgeon to the Rampur Battalion, on the *Swietenia febrifuga*.¹⁰⁷ Breton did not mention the active principle, but detailed how, following Roxburgh, he had taken up research on the bark, and described the positive results encountered by him and several other surgeons in different parts of India when using it to treat intermittent fevers, gangrene and bilious problems. He once again asserted that *Swietenia* was "an efficient substitute for the Peruvian bark". His plea for the scientific recognition of the bark, although now redundant, was nevertheless poignant:

If this bark shall be ultimately proved, (as I am almost certain it will,) equal in effect to the cinchona, the benefit that will result from it to Great Britain, and her vast dependencies in the East, especially in the present precarious state of our actual relations with America, will be incalculable.¹⁰⁸

¹⁰³ Duncan, op. cit., note 73 above, p. 186.

¹⁰⁴ Markham, op. cit., note 66 above, p. 32.

¹⁰⁵ Duncan, op. cit., note 73 above, p. 186.

Emphasis added.

¹⁰⁶ *Ibid.*, p. 59.

¹⁰⁷ P Breton, 'On the efficacy of the bark of the *Swietenia febrifuga*, as a substitute for that of the cinchona', *Medical and Chirurgical Transactions*, 1821, **11**: 310–29.

¹⁰⁸ *Ibid.*, p. 313.

Swietenia continued to be available in Indian bazaars with a reputation for curing intermittent fevers.¹⁰⁹

As a footnote to all this, a rather inconsequential letter from William Twining, an EEIC surgeon, sent to Nathaniel Wallich (superintendent of the Calcutta Botanical Garden, Roxburgh's successor) in 1834, mentioned that William O'Shaughnessy (surgeon of the EEIC, shortly to become professor of chemistry and medicine at the Calcutta Medical College) had experimented on the Neem and Rohuna barks (the names sometimes used for the *Soymida* in north India) and had found no traces of quinine in either, adding, "This is what you predicted of O'Shaughnessy's experiments."¹¹⁰ However, there is some doubt about this as well; another British surgeon Edward Waring later wrote that what was often sold in the Indian bazaars under the name of "Rohuna" was in fact the *Nux vomica* bark. He also claimed that although O'Shaughnessy "speaks slightingly of its [*Swietenia*'s] powers" his opinion was based "rather on theoretical grounds than on actual trials with it".¹¹¹ So the efficacy of *Swietenia* remained unclear. This ambiguity is indicative of its status in modern medicine, which had found the panacea.

Conclusion

While peripheral networks gathered much information, verified claims and facilitated experiments, they did not ensure the scientificity of knowledge. The scientific motivations in the distant colonies were not always in tune with those of the metropolis. Londa Schiebinger has analysed a similar metropolitan rejection of a colonial medical item in her study of the peacock flower used as an abortifacient by slave women in the West Indies.¹¹² When brought to Europe, the knowledge of its abortifacient properties failed to make the voyage and it never received recognition in Europe. Schiebinger attributes this rejection to the attitude of the scientific elites of Europe towards gender and female bodies. Researches on such topics were not considered prestigious enough. Moreover, abortifacients remained a problematic political and religious topic in Europe, thereby inhibiting the knowledge of such New World medicinal plants. Although the issue of gender was a crucial factor in this case, I wish to suggest that rejections of colonial medical items were taking place at a general level as well as within a wider politics of scientific sifting. The rejections were not just of a bark or of its ethnology and history, but also of the various modes of understanding that had been nurtured in the colony.

While Europe from the seventeenth century was being flooded with exotic and alternative medicinal plants collected through networks in the colonies and beyond, its

¹⁰⁹ E J Waring, *Pharmacopeia of India, prepared under the authority of Her Majesty's Secretary of State in India in Council*, London, W H Allen, 1868, p. 55.

¹¹⁰ W Twining to N Wallich, 8 July 1834, Wallich Correspondences (1833–1835) (Box 19), Calcutta Botanical Garden Library.

¹¹¹ Waring, op. cit., note 109 above, pp. 444–5.

¹¹² Londa Schiebinger, *Plants and empire: colonial bioprospecting in the Atlantic world*, Cambridge, MA, Harvard University Press, 2004.

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scientific institutions were simultaneously subjecting them to new forms of scrutiny, sometimes rendering the items and the networks irrelevant and ineffective to the new tradition. This reflects the centripetalism of science in the age of empire and expansion. To return to the problem of periphery and metropolis in colonial science, this paper has argued that the scientific practices of the periphery were no less creative or persevering than those of the metropolis, but that the determinants of modern science, and thereby its truth, lay elsewhere.

How far did the discovery of quinine help to identify cinchona or the Peruvian bark as the key species for malarial treatment and end the search for alternatives? The years after 1820 saw a great rush in Europe to acquire cinchona and to grow it in habitable conditions elsewhere. As Ray Desmond has stated, “The extraction of the alkaloid quinine by two French chemists in 1820 made medical history. Cinchona became a coveted plant for nations like Britain and the Netherlands with colonies in the tropics where malaria was endemic.”¹¹³ Soon the logic of alternatives was replaced by that of transplantation. Supporting the introduction of cinchona to India and discussing the “Value of Quinine”, Markham wrote,

India and other countries have been vainly searched for a substitute for quinine, and we may say with as much truth now as Laubert did in 1820—“this medicine, the most precious of all those known in the art of healing, is one of the greatest conquests made by man over the vegetable kingdom. The treasures which Peru yields, and which the Spaniards sought and dug out of the bowels of the earth, are not to be compared for utility with the bark of the quin-quina-tree, which they for a long time ignored”.¹¹⁴

To put the issue of *Swietenia* / *Soymida* and other barks in perspective, a brief overview of the introduction of cinchona into India will be useful. After the discovery of quinine, several scientists and botanists working in the subcontinent, such as Royle, Hugh Falconer, Henry Piddington and others, had argued for the introduction of cinchona plantations. They suggested several sites like the hills of North Bengal and the Nilgiri mountains.¹¹⁵ Markham finally introduced the Bolivian and Peruvian varieties to India in the Nilgiris in 1861.¹¹⁶ The alternatives to cinchona that were being locally recommended for plantation were disregarded. When the Agricultural Society of India proposed the introduction of cinchona in 1857 they also appealed to the authorities for a trial of *Atees* or *Atibisha* or Aconite (*Aconitum heterophyllum*, *A. forex* etc.) as an antidote to malaria. Wallich had noted in his *Plantæ asiaticæ rariorés* (1832) that this plant had been used in India for centuries for intermittent fevers and was an ideal alternative to cinchona. As one member of the

¹¹³Ray Desmond, *The European discovery of the Indian flora*, Oxford University Press and Royal Botanic Gardens, 1992, p. 222.

¹¹⁴Markham, op. cit., note 66 above, pp. 34–5.

¹¹⁵Abhijit Mukherjee, ‘The Peruvian bark revisited: a critique of British cinchona policy in colonial India’, *Bengal Past and Present*, 1998, 117: 81–102, on pp. 84–5.

¹¹⁶Williams, op. cit., note 13 above, pp. 431–42.

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Agri-Horticultural Society wrote in 1857, “I do not consider *Atees* a panacea, it must fail sometimes as other remedies do, even quinine itself, but that it is the substitute for quinine is not the slightest doubt in my opinion.”¹¹⁷ However, from the metropolitan and imperial perspective, cinchona had already become *the* panacea and the search for alternatives was over.

¹¹⁷ Letter from Mr Henning, assistant surgeon, Oorai, to Cecil Beadon, secretary to the government of Bengal, undated, *J. Agr. Hortic. Soc. India*,

1857, 9: cclix, quoted in Mukherjee, op. cit., note 115 above, p. 97.