CHAPTER III

EMPIRE, ECONOMIC BOTANY AND ROXBURGH

Since the sixteenth century, exploration of sea routes provided a large area to ‘discover’ the natural resources for the service of empires. By the eighteenth century, natural history contained a chain of inquiry that included local studies of botany and zoology, collection of natural artefacts, geographical and meteorological descriptions, geological study, landscape and gardening design, and other forms of inquiry conducted by an international group of practitioners. At the same time, Linnaeus provided two main responsibility to botany, survey of new resources and acclimatization of plants. This approach was guided by the ‘Camaralist’ principle, where Linnaeus focused on the way to reduce country’s dependencies on expensive imports (such as tea) by finding alternatives that could be grown in home. In this context, economic botany emerged and it became a part of imperial tool to gain commercial gain. In this chapter I will discuss on the different ‘discoveries’ and the acclimatization process of new species in the ‘European botanical sphere’\(^1\) under William Roxburgh.

In the beginning of the eighteenth century, the Whigs took over Britain’s policies and ideology, which opened the path of economy botany. From their inception, the Whigs were strongly protectionist in economic policy, with free trade policies was being advocated by Tories. As C.A. Bayly described Britain of 1780s and 1790s, as a ‘Knowledge panics’\(^2\). According to Richard Drayton, this era was the perfect amalgamation of scientist and politician.\(^3\) Joseph Banks, in collaboration with Pitt and Dundas, and in direct imitation of French policy and experiment, converted ‘search for nature’ to ‘exploration of plants’

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\(^1\) From “European botanical sphere” I mean to European ‘curiosity’ for the economical and political means. It consist collector, botanists, horticulturists, learned societies and above all policy makers of different companies including Court of Directors, merchants and King.

\(^2\) C. A. Bayly, “Knowing the Country: Empire and Information in India”, Modern Asian Studies, Vol. 27, Issue 01, 1993, pp. 3-43.

through transplantation and survey, which stretched from the Pacific to Bengal and the West Indies.

The East India Company was ultimately responsible to its shareholders to produce dividends, thus the driving force in any exploration, whether botanical, zoological or mineralogical was commercial gain. In addition to it, Roxburgh period in India was parallel with the war. From the early 1790s, Britain was at war with France and therefore needed to search the alternatives, which can make him independent and crush the monopoly of political rivals. Search for the local species of hemp, teak, sugar and other articles, which were essential for European domestic manufacture industries, started. As the *Transaction of Society* noted:

“In the present state of Commerce of this country, when the Enemies are endeavouring to close every Foreign Port against us, it is the Society’s wish and endeavour to show the great Advantages and Resources which may be derived from our colonies, and to give every encouragement in facilitating their Efforts to furnish Articles which will answer the purpose of those usually derived from Foreign Kingdoms. Supplies from such being generally precarious, and procured at a great Expense to this Country.”

Roxburgh, since his stay at Samalkot, was involved in the search of plants which can help empire in its trade, commerce and monopoly. At Samalkot, he established a garden where he introduced various plants such as pepper wines, coffee, sappan wood, bread-fruit tree, and indigo. This experience helped him to procure different species of spices, hemp, sugar, and timber in his later years at Calcutta Botanical Garden. In this chapter, I will describe the European demand of different important commodities and how Roxburgh procured that item for the empire.

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Fibrous Plant: Hemp, Sunn, Calooee

Chinese culture was mostly associated with the different age defining discoveries. They invented gunpowder, the crossbow, paper, and a myriad of hemp-based products. It was the Venetian Republic, the first western European country, which industrialized around hemp. In fact, Venice was the first place that elevated the art of processing raw hemp into rope, sails and fine linen like cloth. The Dutch took an early lead in hemp production, because of superior technology and equipment. In Holland, windmills (themselves powered by hemp sails) provided power to crush the stalks of hemp. The enormous saving of manual labour enabled the Dutch to produce vast quantities of canvas and rope that aided their ascendance as a powerful seafaring nation. The Dutch used advanced techniques of bleaching hemp and linen. In 1756, they introduced dilute sulphuric acid to the six month process for retting, washing, heating and watering, and cut the time required in half. But still production was not enough to match the western power’s needs. The Dutch traded with the Scandinavian and Baltic countries, and especially with Russia and Italy. The Baltic Sea during the late medieval and early modern periods was described by historians as the Nordic, equivalent of Braudel’s Mediterranean. The northern zone was darker, colder and poorer, and its exports of grain, timber, hemp and flax were high in bulk and relatively low in value by weight. So there was huge dependency of Europeans on Baltic regions. Because of the Dutch merchants, who conducted this trade with greater efficiency than their rivals, English had to take some hard steps towards their independencies.

In 1611, formal orders arrived from England and instructed the colonists to raise hemp. The Spanish also cultivated hemp, when they first arrived in the Americas, and so did

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the French, who colonized the northern parts of America. The Scythians carried hemp from Asia through Greece and Russia into Europe, and later Arabs brought hemp from Africa into Spain and other ports of entry on the Mediterranean Sea.\(^7\)

Commercial rivalry or England’s steps towards independency on hemp products opened the path for England’s major navigation laws, which aimed to secure a greater share of the international freight trade and became the main reason for the outbreak of the Anglo-Dutch Wars. It is noticeable that England’s soil and climate were suited for the growth of Hemp and Flax, yet at great expense, the nation purchased Dutch cordage and linen, and French canvas and nets, with Baltic raw materials. The changes started in 1677, when Tudor policy insisted on hemp cultivation for every hundred acres of cultivated land. It was formulated that half an acre had to be planted with either crop to avoid paying a fine, still foreign goods were cheaper than domestic product due to the high price of English land and labour.\(^8\) In the late seventeenth and early eighteenth centuries, because of war in northern Europe, Baltic trade became more hazardous for the merchant and expensive for the maritime state. To protect the cordage and canvas, industries tariffs were raised. There was national need to search the alternative supply for raw materials.

American colonies were the very suitable land to cultivate hemp. The British Empire was, somehow, dependent on the American colonies, to cut the dependency on Baltic trade, for the hemp supply.\(^9\) In due course of time, America became the major supplier for England, but after the defeat in the American War of Independence, Britain once again became dependent on Baltic trade. With that, “in 1786 Britain’s twenty-year commercial treaty with Russia expired, and the price of Riga hemp in London immediately rose from 27 pound to 41

\(^8\) Ibid., p. 118.
\(^9\) By the late 1700s a major ship-of-the-line in the British navy required 80 tons of Hemp in sail and rope, this equated with 350 acres of hemp production. The sails and rigging had to be completely replaced every 3-4 years.
pound per ton.” Each ship required more than two hundred tons of rope and sails, and much of that needed to be replaced every couple of years. So the search of local substitute for hemp became the primary motive for British. Because, hemp production was labour demanding and a source of cheap labour was valuable to secure a constant supply.

The use of local products by the Dutch East India Company -Vereenigde Oost-Indische Compagnie (VOC) for anchor cables was not new thing. After the VOC established itself in Ceylon and on Malabar Coast, enough cayer rope (made from the outer fibres of the coconut) was available, but large quantities of hemp rope were still shipped to Asia. Attempts were made to produce rope with local raw materials. But, these projects were unsuccessful due to the lack of manpower and problems associated with the huge cargo capacity. An attempt to establish a weaving mill in Bengal was also unsuccessful.

When Sir Joseph Banks observed New Zealand, on the Voyage of the Endeavour in 1770, he pointed out that the natives produced cloth and rope from a plant which was later to be known as the New Zealand flax. He hoped that this plant might be superior to the traditional hemp. The experiment to develop New Zealand flax as a substitute for Cannabis was given top priority and one of Governor Captain Arthur Phillips, first action after the

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11 In the southern colonies of North America, African slaves were used to produce tobacco and cotton. In the northern colonies of New England, convict labour from Britain was employed. There were no penitentiaries until the 1800s. Convicted felons were bonded as servants until they had ’paid their debt to society’ through labour. By 1770 (the year Captain Cook claimed Australia for the British Empire) over a thousand convicts a year were being transported mostly to plantations in Virginia and Maryland in North America.
12 From Surat and Coromandel, the so called ‘vijger ropes’ were imported to Batavia but as it turned out they did not meet VOC (Vereenigde Oost-Indische Compagnie) standard. In 1625, Batavia asked for more ropes from the Netherlands because the ropes materials from Surat were inadequate owing to the speed with which they rotted and yet still cost 4000 guilders.
13 In 1642, two years after the fortified city of Galle on the south tip of Ceylon was captured from the Portuguese (by the Dutch), a request was made for European ropes to be sent via Batavia. Hemp from Bengal was shipped in large quantities to Batavia where in 1660 the VOC established a yarn spinning mill and sailcloth-weaving mill.
arrival of First Fleet, was to despatch Lieutenant King “with a party of convicts and a qualified weaver to Norfolk Island”\textsuperscript{15}. In 1793, Lieutenant King wrote the following letter to Under-Secretary of State for War, Evan Nepean:

“To my public letter respecting my trip to New Zealand I must refer you for every circumstance attending it, and I hope to hear that my proceedings on that business will be approved of. I am confident much public good would result to the commerce of Great Britain and these colonies if a settlement was made at the Bay of Islands or the river Thames. To my letters I must refer you for my ideas on that subject. Since my return from that country I am more confirmed in its apparent utility. Weavers and rope makers should be sent out with their proper implements, as it will answer much better to send the flax manufactured than in the raw state. If the plants get safe home, I think too much attention cannot be paid to the cultivation of it, as it will grow most luxuriantly in situations where scarce anything else will vegetate. I have sent a box with some very fine plants to Sir Joseph.”\textsuperscript{16}

Different publications on Hemp Cultivation explain the need for new steps to fulfil the sea powers demand.\textsuperscript{17}


2) The Mode of Cultivating and Dressing Hemp, by the Abbe Brulles, printed by order of the Lords of the Committee of Council for Trade and Foreign Plantations, Quarto, 1790.


4) Instructions for the Culture and Preparation of Hemp in Canada, in a Letter to the Lords of his Majesty’s Council for Trade and Foreign Plantations, dated 17\textsuperscript{th} of June, 1802, by John Taylor, Esq.


\textsuperscript{17} Robert Wissett, On the Cultivation and Preparation of Hemp, as Also, an Article, Produces in Various Parts of India, (London, 1804). pp. vi-vii.
The Lords of Privy Council for Trade and Foreign Plantations, in a Letter to the Court of Directors of the East-India Company, on 4\textsuperscript{th} February 1803, recommended to the Court to encourage, as much as possible, the growth of strong hemp in such parts of their dependencies in India.\textsuperscript{18} Hemp was not altogether unknown in India but its properties were not sufficiently understood. Mainly it was cultivated for the purpose of obtaining an intoxicating drug. The Indian made their cordage and fishing nets by the plant name Sunn (\textit{Crotolaria Juncea} of Linnaeus). William Roxburgh compared cordage “to the sinews and muscles of a ship”, and he carefully exhibited the result of a variety of comparative estimates of the strength, like of English hemp, of cannabis, of coir, or the fibres of the husk of the cocoa nut and of Ejoo, \textit{Sanguerus Rumphi}i etc.\textsuperscript{19} There were many other vegetable substances, which were used by the natives for cordage, such as:\textsuperscript{20}

- Murgha – Aletris Nervosus.
- Kantala – Agave Americana.
- Douchy – Robinia Cannabina.
- Merty Paut – Hibiscus Cannabinus.
- Coir – Palms
- Gomuti – Palms

But the principal, and in the greater use, are,
- Sunn – Crotolaria Juncea
- Paut – Corchorus Olitorius

The following statement (Table: 3.1) on the quantities of hemp and flax, imported into Great Britain in the years 1786 to 1803, shows the immense national advantages which was derived from growing own hemp and flax.\textsuperscript{21} It appears by a letter from the Marquis Wellesley, Governor-General of Bengal that European hemp had increased in price since

\begin{itemize}
\item Robert Wissett, \textit{On the Cultivation and Preparation of Hemp, as Also, an Article, Produces in Various Parts of India} (London: 1804), p. vi.
\item Robert Wissett, On the Cultivation and Preparation of Hemp, as Also, an Article, Produces in Various Parts of India, (London,1804). p 19.
\end{itemize}
1792, from 23l. 10s. to 61l. per ton.\textsuperscript{22} A major activity, in the 1790s and early 1800s, at the Calcutta botanic garden was experiment on the cultivation of Asian and Europeans varieties of Hemp and flax, in the hope of finding satisfactory substitutes for the Baltic varieties and thereby establishing an alternative source of supply.\textsuperscript{23}

<table>
<thead>
<tr>
<th>Years</th>
<th>Hemp (Cwt.)</th>
<th>Flax (Cwt.)</th>
<th>Years</th>
<th>Hemp (Cwt.)</th>
<th>Flax (Cwt.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1786</td>
<td>291,482</td>
<td>244,469</td>
<td>1795</td>
<td>574,622</td>
<td>225,852</td>
</tr>
<tr>
<td>1787</td>
<td>379,801</td>
<td>269,679</td>
<td>1796</td>
<td>618,485</td>
<td>321,238</td>
</tr>
<tr>
<td>1788</td>
<td>564,070</td>
<td>261,970</td>
<td>1797</td>
<td>488,176</td>
<td>209,681</td>
</tr>
<tr>
<td>1789</td>
<td>472,263</td>
<td>139,224</td>
<td>1798</td>
<td>647,832</td>
<td>389,987</td>
</tr>
<tr>
<td>1790</td>
<td>592,305</td>
<td>257,221</td>
<td>1799</td>
<td>752,387</td>
<td>418,736</td>
</tr>
<tr>
<td>1791</td>
<td>378,811</td>
<td>308,700</td>
<td>1800</td>
<td>596,000</td>
<td>410,000</td>
</tr>
<tr>
<td>1792</td>
<td>567,188</td>
<td>243,323</td>
<td>1801</td>
<td>741,000</td>
<td>271,000</td>
</tr>
<tr>
<td>1793</td>
<td>553,831</td>
<td>271,248</td>
<td>1802</td>
<td>488,000</td>
<td>277,000</td>
</tr>
<tr>
<td>1794</td>
<td>582,755</td>
<td>348,366</td>
<td>1803</td>
<td>727,000</td>
<td>294,000</td>
</tr>
</tbody>
</table>


When William Roxburgh, then Superintendent of Calcutta Botanic Garden, saw the Sinclair appointment to establish the cultivation of hemp, he became surprised and wrote:

"I was rather surprised on my return to Bengal (1797-98) to find the directors had sent out a person, (Mr. Sinclair) to establish the cultivation of hemp, a thing I had begun sometime before. Even on the coast of Coromandel, ten or twelve years ago, I had made a most important trial, the success of which was laid before that Government, to be sent to the Honourable Court of Directors: and again in Bengal, since my appointment to the station I now hold. Mr. Sinclair is dead, and the experiment is still carried on in a most expensive manner; whereas it could be continued where it was first begun, in the Botanic Garden, at no expense, and with more prospect of success.\textsuperscript{24}

Roxburgh, further proceeded to state that instead of these costly experiments, which contributed to check improvements of all kinds, recommended small rewards to such


Europeans as many be inclined to cultivate this valuable article. He published a paper on *Observations on the Culture, Properties and Comparative Strength of hemp, and other Vegetable Fibres, the Growth of the East Indies.* Roxburgh found the true hemp plant (*Canabis Sativa*) both on the Coromandel Coast and in Bengal. He encouraged the cultivation of the plant in interior part of Bengal and Behar. He also recommended palm trees for cables and cordage in the time of war and difficulties:

“...because its fibres ready prepared by nature, being flexible, strong, and at the same time the most durable, and most convenient for the cables, and cordage of all kinds, that can be desired. It also yields great abundance of palm wine, which may be converted into sugar, or ardent spirits; and when the tree is old, its pith is the basis of the Sago we so much value. I have distributed many hundred plants (about 100,000 have been reared in the Botanic Garden, since the date of this letter), besides many thousand seeds in the ground. Drawings and a description of this most valuable tree were sent to the directors, under the name of *Sanuers Rumphii.*”

Roxburgh wrote to C.R. Crommeline, Secretary to the Government in the Public Department, that no better way was to procure the seeds of China and Manilla hemp than by an application to the Super Cargoes at Canton and sending copies of the accompanying paper to that place to Prince of Wales Islands and Malacca. Earlier in 1796, Roxburgh had asked for the seeds of Flax, Hemp and Sugar Cane. And at the close of the same year, he received a quantity of seeds under the name China hemp with instructions for rearing, but it turned out to be common Jute. He sent hemp and flax seed and plants to A. Barnard, secretary to the government of the Cape of Good Hope from the ship *Loyalist.* Then Peter Speke Esq.

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27 Home Department, Public Branch, 30th September, no. 60.
28 Home Department, Public Branch, 25th June 1801, No. 40.
Table 3.2 Different Species of Fibrous Plants

<table>
<thead>
<tr>
<th>Materials, or Names of the Plants which yielded them.</th>
<th>Average weight at which each sort of cord broke.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>When fresh.</td>
</tr>
<tr>
<td></td>
<td>White</td>
</tr>
<tr>
<td>1 Hemp from England, . . . . . . . . . . . . . . . . .</td>
<td>163</td>
</tr>
<tr>
<td>2 Ditto growth of India . . . . . . . . . . . . . . . .</td>
<td>139</td>
</tr>
<tr>
<td>3 Coir . . . . . . . . . . . . . . . . . . . . . . . . . .</td>
<td>87</td>
</tr>
<tr>
<td>4 Epeo . . . . . . . . . . . . . . . . . . . . . . . . . .</td>
<td>65</td>
</tr>
<tr>
<td>5 Robinia cannabin, rip. . . . . . . . . . . . . . . . . .</td>
<td>66</td>
</tr>
<tr>
<td>6 The same cut while blossoming . . . . . . . . . . . .</td>
<td>46</td>
</tr>
<tr>
<td>7 Crotalaria juncea . . . . . . . . . . . . . . . . . .</td>
<td>68</td>
</tr>
<tr>
<td>8 Corchorus eborac . . . . . . . . . . . . . . . . . . .</td>
<td>67</td>
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<tr>
<td>9 Corchorus cupulac . . . . . . . . . . . . . . . . . .</td>
<td>67</td>
</tr>
<tr>
<td>10 Flax, growth of India . . . . . . . . . . . . . . . .</td>
<td>59</td>
</tr>
<tr>
<td>11 Agave Americana . . . . . . . . . . . . . . . . . .</td>
<td>110</td>
</tr>
<tr>
<td>12 Aletris nervos . . . . . . . . . . . . . . . . . . .</td>
<td>120</td>
</tr>
<tr>
<td>13 Theobroma Augusta Linn. . . . . . . . . . . . . . .</td>
<td>74</td>
</tr>
<tr>
<td>14 Theobroma guazuma . . . . . . . . . . . . . . . . .</td>
<td>53</td>
</tr>
<tr>
<td>15 Hibiscus tiliaceus . . . . . . . . . . . . . . . . .</td>
<td>41</td>
</tr>
<tr>
<td>16 Hibiscus Manihot . . . . . . . . . . . . . . . . . .</td>
<td>61</td>
</tr>
<tr>
<td>17 Hibiscus mutabilis . . . . . . . . . . . . . . . . .</td>
<td>45</td>
</tr>
<tr>
<td>18 Hibiscus, from Cape of . . . . . . . . . . . . . . .</td>
<td>22</td>
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<tr>
<td>19 Basilia, a scendent sp . . . . . . . . . . . . . . . .</td>
<td>69</td>
</tr>
<tr>
<td>20 The same, but different prepared . . . . . . . . .</td>
<td>56</td>
</tr>
<tr>
<td>21 Sterculia villosa . . . . . . . . . . . . . . . . . .</td>
<td>53</td>
</tr>
</tbody>
</table>


wrote to Richard Hall Esq. Member, Council of Super cargoes at Canton about procuring seeds of the species of Hemp from China and his particular attention to the transmission by successive conveyances of these species.30 Roxburgh got a new species, from Bencoolen by the Governor Mr. Ewer, Caloee, a shrubby species of Urtica. Roxburgh found that this plant was strongest plant material he had ever seen. In 1807, he wrote to Dr. Charles Taylor about Calooee hemp and the difficulties in cleaning:

“I can cultivate this plant to any extent, as it grows readily from slips and cuttings, is perennial, and yields three or four cutt ings, or crops, annually; but the cleaning of the fibres from the glutinous fleshy exterior coat, with which they are covered and intermixed, is uncommonly difficult.”31

Unfortunately British Government did not get their requirements from these species of hemp, including Sunn. So they asked for the experiments on good quality of hemp. In

30 Home Dept., Public Branch, Controlling Agency, 30th September 1801, no. 63.
31 Papers Relating to the East India Affairs, Ordered by the House of Commons, to be Printed, 22 June 1813., pp. 5-6.
April 1807, the Bombay Government were instructed that the honourable Court considered it an object of national importance to be able to supply India hemp for the use of the royal navy, and general consumption in England. Further the letter said that, particular attention to this object was enjoined at this time; immediate importations were not wanted, improvement of quality, more than quantity, was to be considered; and extension of culture, with improved methods of cleaning and dressing it, seemed to be the chief objects, the honourable Court had then in view.

Sugar

Sugar-cane is a grass that captured all attention from the sixteenth century, when it was introduced by Portuguese in their colony. The Muslims introduced the sugar-cane into Sicily and the South of Europe, and the Portuguese into the Canaries, from there it was taken to Hispaniola in the year 1506. In West Indies, before the middle of the eighteenth century, no less than three hundred ships went annually from Great Britain, besides those from other places. Even France described in 1701, in a memorial by a French Chamber of Commerce, as “owing all its increase and splendour to the commerce of its sugar islands”. Portuguese and French enjoyed the fully dependency of Europe on them.

A letter written by Paul Heinrich Gerhard Moehring to Carl Linnaeus mentioned that “Make me happy by answering this letter before you leave Belgium!” In a postscript Moehring asked if it is possible to get at seeds of tea, coffee and sugar in Holland. Meanwhile arrival of indigo from the East Indies made remarkable profit for the

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32 The first Sugar-canes found in the West-indies were at Hispaniola in 1506. John Forbes Royle, Essay on the productive Resources of India, (London: 1840), p. 85.
34 Portuguese controlled the sugar production of Brazil and so the French in St. Domingo. St. Domingo became the largest sugar production area in 16th -17th century.
35 He was a German physician, botanist and zoologist.
British East India Company. So the Company decided to invest this wealth for the encouragement of sugar cultivation in Bengal. In April 1789 a committee of the East India Company represented to the Court of Directors that the introduction of Sugar can be undertaken. The Court of Directors issued instructions to the government of Bengal that a quantity of sugar should be sent to England on trial. In the year 1790, a quantity of Benares Sugar, with sample of others sugars and of tobacco leaf, the outcome of Bengal and Bihar (Behar), were transmitted to England.\footnote{Essay on Productive Resources of India, p. 87.} The first shipment of 97 cwt (hundredweight) from India reached England in March, 1791. The Court of Directors decided to increase the quality of Bengal sugar in respect to West Indies sugar.\footnote{One great objection by the planters was, the quantity of Clayed Sugars produced from the French islands having in refinements superiority over Muscovado Sugar. The Clayed Sugar of the British Islands not having paid more duty than the Muscovado Sugar, i.e. 10s. to 30s. per cwt difference between the value of the Clayed and Muscovado sugar. \textit{A Report of the Proceedings of the Committee of Sugar-Refiners, for the Purpose of Effecting A reduction in the High Prices of Sugar, (London: 1792), p.15.}} As we know sugar plantation of West Indies was totally dependent on slaves and the periods between 1791-1794 was the period of slave insurrections and agitation against slavery abolition. Britain had his own interest in the issue of slavery abolition. This boycott was totally related to increased price of sugar in the last five years. It started with number of slave insurrections against European treatment to increase the production of sugar by all means, as St. Damingo insurrection. So the political, philosophical and socially supports decreased the demand of West Indies sugar. British East India Company wanted to cash the situation of the boycott of slave sugar. In this way, after 1791, it was real consideration of Company to project the Bengal sugar as a slave free sugar. This was the perfect time for Bengal to participate in sugar trade, however, the remarkable lead over West Indies sugar only could be taken by 1820s.
The East-India Company was called upon at a General Meeting of the Public to lend their assistance towards effecting a reduction of the price of Sugar, by encouraging importations of it from the East-Indies. On the 15th March 1792 a General Court of Proprietors held for the purpose of considering an application intended to be made to His Majesty’s Ministers or to the Parliament, for lowering the duties then payable on East India Sugar. On this occasion a Report by the Committee of Warehouses, dated the 29th February 1792, on the culture and production of Sugar in British India, was read. Court of Directors ordered that the collectors of the Indian revenues should be called upon “to ascertain various particulars relative to the existing state of the sugar cultivation, its increase or decrease; whether it laboured under any peculiar disadvantages which could be removed by proper encouragement.”

In reply to these orders, some of the botanists like Dr. Roxburgh and Buchanan Hamilton wrote. Roxburgh wrote in a letter An account of the Hindoos method of cultivating the sugar cane and manufacturing the Sugar and Jagary in the Rajahmundry Circar. This was for increasing the quality of sugar, basically observed by natives of the

Ganjam district.\textsuperscript{40} He added ‘at a period like the present when the importation of East India Sugar has become so much an object of importance to Great Britain, in consequence of the present state of some of the best of the West India Sugar Islands every enquiring that may tend to open new source from whence that wholesome commodity can be procured as the cheaper rate, is of national importance.’ About the area and quality, he further wrote ‘the introduction of a new branch of agriculture amongst the natives, I know from experience, to be attended with infinite trouble, therefore where we find a Province or district in which the culture of the Sugar Cane, and making of Sugar has been in practice from time immemorial there we may expect without much exertion to be able to increase the culture and improve if necessary, the quality.’ Their consideration on the expense for the cultivation of sugar was very prominent. A. Anderson (Surgeon at Ganjam District) sent the method of cultivation of Sugar in Ganjam District to Roxburgh. ‘The rate of freight from India to England being so very high, renders is the more necessary to make the sugar for that market of a good quality which can be done here at infinitely less expense than on the West India Islands where labour is so exceeding high’.\textsuperscript{41} Roxburgh quoted Alexander Anderson in his \textit{Method of Preparing the Sugar in the Ganjam District} (Samalcotta, 20\textsuperscript{th} June, 1792):

> “should political motives prevent the importation of East India Sugar into England is even then of infinite import to the Companies Territories to have the qualities of their sugar improved so as to render unnecessary the importation of these of china and Batavia large sums being annually thrown into these places for their commodity which we as the same time possess every advantage for making this necessary article of the best quality to the full in as high a degree as either the china or Dutch besides on own wants, we have every


reason to imagine that we might soon be able to supply the Malabar Coast, Persia and Arabia, with Sugars, whereas present they are chiefly supplied from China and Batavia.”

When these efforts towards the cheap Indian sugar production were making in India, the West-Indians were assisted by the introduction of a new kind of sugar cane. This was the Otaheite cane of which Captain Bligh says, “some very fine Sugar Cane was brought to me, each of the pieces was six inches round.”

The French had lately (about 1794) introduced three new species of the sugarcane in Martinique and other West-India colonies; one from the Island of Bourbon, said to have been brought there from the Coast of Malabar, another from Otaheite, and third from Batavia. The Bourbon and Otaheite canes were nearly of the same nature: they were much larger than the old West-India cane. They ripen sooner, being fit for cutting in ten months: and their juice also granulated (or become sugar) sooner, and threw up less scum in the boiling, than that of the old canes. They also refitted the injuries of excessive dry weather, and the ravages of a destructive insect, called the borer. The first trial of the new canes in any British colony was made in the year 1793, by a gentleman of Montserrat, to whom Mr. Pinnel gave some of his plants. However, in the time of Cook’s very first voyage, it was noted “sugar is also produced here (Batavia) in immense quantities, very great crops of the finest and largest canes that can be imagined, are produced with very little care, and yield a much larger proportion of sugar than the canes in the West Indies.”

When in other countries there were attention for introduction of new kind of sugar cane, but in India the efforts were on the improvement of the culture and manufacture of

44 He was a considerable planter in the French Island of Guadaloupe.
sugar. Dr. Roxburgh was well aware of the importance of this subject. In the year 1796, he wrote to government for the Supercargoes at the Canton for the seeds of flax and hemp as well as various sort of sugar-cane. The new species of *S. sinensis* was introduced from China into the Botanic garden at Calcutta in 1796 in the hope of better result as it was so solid and hard for two great enemies of East Indian Plantation (that was jackal and white ants). And at the same time it saw the drought much better than the sorts of general cultivation. It produced a profitable crop even to the third year, while the common cane of India was renewed every year. This species was sent to Roxburgh by A. Duncan, surgeon to the factory at Canton. Roxburgh wanted to distribute this to all over the rich soil area like Bengal. He got positive result of this introduction, as Richard Carden, Superintendent of the Company’s rum and sugar works at Mirzapore Culna in Bengal, accepted in his letter to Roxburgh of 13th August, 1801 that “I did purchase twelve cottas of the best Bengal canes last January, merely as an experiment, which yielded just half the quantity of sugar my China canes did.”

Roxburgh described *Saccharum* genus with eleven species in the *Flora Indica*. *S. officinarum* (Linn.) species was very common in the Rajahmundry for the brown raw sugar. In Bengal, there were three varieties cultivated. First was common yellow cane called as Bengalees Poori. Secondly, the purple cane called as Kajooli, which was said to yield juice one-eight part richer than the yellow cane, but the sugar extracted was always of a dark colour. The third and last, was a very large, light coloured cane, called Kullooa.

The price of sugar went up in the time of war from 32 shillings per hundred weights in 1793 to 87 shillings per hundred weight in 1798. However, in the beginning of the

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nineteenth century, East Indian Sugar flooded the London market, driving the price of sugar down to 28 shillings per hundredweight.\textsuperscript{49} It was also brought to the notice that:

“The Additions also contain a plan for regularly increasing the crops upon sugar estates, for preserving their stock and Negroes, and for rendering them in every respect more lucrative and prosperous than they are at present. When the owner of a sugar estate receives a good crop, his manager becomes intitled to a handsome reward; and as the produce is rendered still greater, his advantages are correspondently increased.”\textsuperscript{50}

Roxburgh estimated the returns from the irrigated lands of Rajamundry at 5,000 pounds of coarse sugar the acre. Capt. W.H. Sleeman (Bengal army) estimated, on a large scale, the average returns from lands watered and well manured in Bengal, at 2,500 pounds the acre. However, the species (purple sugar-cane), about which Roxburgh discussed yielded abundant quantity of sugar, but in poor quality.\textsuperscript{51}

Roxburgh instructed Smith during the Moluccas trip (1797) to procure some of the sugar-cane plant as the Dutch at Batavia cultivated much sugar-cane and their sugar were of a good quality. Roxburgh also suggested learning the method of culture, including quantity of water, period of planting, cutting and the mode of manufacturing the sugar, if it differed materially from the pursued in the West Indies and Bengal.\textsuperscript{52} In this way, Roxburgh was interested in the cultivation method, alternative species and transplantation of the Sugarcane plants.

**Pepper**

From the time of Marco Polo visit to the East in the thirteenth century, we find the description of pepper trade between Europe and the orient. According to him, the cost of

\textsuperscript{49} A. Meredith John, *The Plantation Slaves of Trinidad, 1783-1816: A mathematical and Demographic Enquiry*, (Cambridge: Cambridge University Press, 16.
\textsuperscript{52} Home Dept., Public Branch, ‘A’, 22\textsuperscript{nd} May, 1797, No. 17
transportation was very high due to the high costs of water and land transportation, tariffs protections, piracy and losses at sea. And when the pepper reached Venice “what at first cost one Scats was raised at the end to 60 and even 70 ducats.” Nutmeg and cloves were more profitable, but pepper was used in greater quantities. Six to eight times more peppers than cloves and nutmeg was shipped from Asia to Europe during the age of discovery. However, it was an ancient royal commodity which was used for culinary taste and medicine, but in modern time suddenly there were high demands of pepper to preserve the meat. But this was not a major reason for the spice demand as Paul Freedman pointed out. Spices were exotic because they came from far away, from mysterious, rich and magical lands. To some degree the orient had always been a source of wonder and was seen by Europeans as teeming with marvels, both strange and appealing. As Sebastian R. Prange analyzed in his article that the desire to control the trade in pepper in particular not only propelled the Portuguese voyages of discovery, but was a key driving force behind the subsequent competition over sources, ports and trade routes.

It was the Portuguese who introduced the importance of pepper trade and Indian market to Europe. The Portuguese transported plants from one region to another, like Coffee from Africa to South America, and dispersed more widely clove plant to the Moluccas and introduced in Ambon. Banned since the time of Dom Manuel, the initiative for the introduction of pepper and cinnamon plants from India to Brazil was taken by the Jesuits. In

55 Ibid.
56 Sebastian R. Prange, “Measuring by the bushel”: reweighing the Indian Ocean pepper trade”, *Historical Research*, vol. 84, 212–235.
58 Since 1506, Dom Manuel, the king of Portugal, turned the spice trade of Lisbon into a Crown monopoly.
1683, ten or twelve pepper plants were thriving in the Quinta do Tanque Garden.\textsuperscript{59} In 1690, two Canarins\textsuperscript{60} arrived from India to work on the pepper and cinnamon plants for cultivation in this garden. They were successful in cultivating cinnamon commercially on plantations, but were less successful with pepper.

By 1605, the Dutch drove away the Portuguese from the Moluccas. Holland gradually established a firm grip over the pepper producing centres near Lampong (Lampung) in Sumatra and Banten in Java. George Richardson Porter\textsuperscript{61} focused on pepper plantation and changing trade pattern in his book “The Tropical Agriculturist”.\textsuperscript{62} When the East India Company first formed a settlement on the coast of Sumatra, its attention was directed to procure an extensive growth of pepper. To this end a stipulation was made by some of the native chiefs, binding them to compel their subjects to cultivate a certain number of pepper vines. The whole of the produce obtained from these plants was to be delivered exclusively to the company’s agents at a price far below what would have constituted a proper remuneration for the labour bestowed on its cultivation and preparation.\textsuperscript{63} Sir Stamford Raffles, in his \textit{History of Java} (1817), observed that “Pepper, which at one time formed the principal export from Java, has for some time, ceased to be cultivated to any considerable extent.”\textsuperscript{64}

In India, the most valuable pepper species was \textit{Piper nigrum}, which was available in the different southern region, especially in Malabar. In the early part of the seventeenth century, the significance of Malabar/Kanara pepper increased. Thus, between 1612 and 1634

\textsuperscript{60} The native Christians of Portuguese India, called Canarins, were also actively engaged in the Indian Ocean trade and deeply involved in the Portuguese Country trade in the late eighteenth and early nineteenth century.
\textsuperscript{61} He was a liberal in politics, and a free trader. He became head of the statistical department of the Board of Trade.
\textsuperscript{62} George Richardson Porter, \textit{The tropical agriculturist: a practical treatise on the cultivation and management of various productions suited to tropical climate} (London, 1833), 306.
\textsuperscript{63} George Richardson Porter, \textit{The tropical agriculturist: a practical treatise on the cultivation and management of various productions suited to tropical climate} (London: 1833), p. 306.
\textsuperscript{64} Ibid.
pepper procured at Malacca, the only source other than the southwest coast of India, accounted for only 3.26 per cent of the total amount of pepper shipped to Lisbon. In 1664, The Portuguese were driven out from their main settlements in Cochin and Kannur (Cannanore) by the Dutch. This was the end of the Portuguese chapter in the pepper trade. But, the Dutch control over spice production and sale was considerably weakened by 1650s, when the pepper cultivation spread to Malay Archipelago. The Dutch could not do anything about it because this area was outside their sphere of influence.

The situation in London mercantile circle reached a climax, when the Portuguese and the Dutch merchants unexpectedly raised the price of pepper from three to eight shillings a pound at the end of the 16th century. This sudden rise in price aroused the fighting spirit of British merchants. They decided to procure their own supply directly from the Far East, to lands where the precious spices were produced. Sir Stephen Soane’s plan became a milestone in the way of spice trade of the British East India Company. The first two voyages were directed at Bantam in Java, where a factory was established in 1602. Since 1613, Sumatra became the chief supplier of the pepper to the Company. The London agreement of 1619 provided an English share of one-third in the trade of the Spice Islands (The Maluku Islands or the Moluccas), and one half of the pepper trade of Java. And English had to contribute one-third of the cost of maintaining the Dutch garrisons in the area. But the 1623 Amboyna massacre compelled the English to give up the islands. In 1615 the British landed in Kozhikode and for the first time in 1636 A.D., they exported pepper from Cochin to England. Gradually, the English entered into trade pacts with all local rulers. By an

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67 More detail on the Massacre has given in the chapter 4 during the discussion on the Dutch Dr. Bounteous.
agreement with the Rani of Attingal (Queen, who reigned the small Kingdom of Attingal) in 1721, the English acquired monopoly rights for the entire pepper trade in the state. In 1723, the English East India Company entered into a contract with Travancore. In these ways, the British East India Company established their hegemony in the trading of pepper and other spices. The Company was mainly responsible for the organized cultivation of spices and developed plantations of tea, coffee and spices.

The decline of Surat and the fall of the Safavid dynasty of Persia had its indirect and negative consequences for the Dutch position in Malabar, because the Gujarati merchants from Kathiawar and Sind who used to buy pepper from Surat and Persia, now procured from Malabar. This caused increasing demand for pepper and a consequent elevation of prices between 1730 and 1740. At the same time, ambitious Raja of Travancore, Martanda Varma, was converting his state into a military power. To finance his state building, he declared a pepper monopoly throughout his territory. Thereafter, the Raja of Travancore delivered the pepper to the English in Anjengo, Vizhinham and Edavai, and to the French in Mahe. He checked the monopoly over pepper, Cardamom and other spices. In, 1766 all outlets were choked off when Mysore conquered Calicut and the Mysore turned the territories into a monopoly zone like that of Travancore. Amidst these development, British needed to explore some other way for fulfilling the pepper demands (at least till 1799, when the British defeated Mysore. The British East India Company was indulged in various wars inside and outside India. For economic backup to military activity and territorial aggrandizement, the persuasion for economic botany was much needed. The Company wanted a substitute of

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69 Ibid. 109
70 Against Maratha (1775-1818), Mysore (1767-1799), Gurkhas of Nepal (1815-16), Burma (1824-25), French in Carnatic wars and Napoleonic War etc.
71 Focus on the botanical exploration of commercial and high valued plants in world market.
Black Pepper into the world market.\textsuperscript{72} To develop the economic botany, William Roxburgh and other botanists contributed a great deal.

**Increasing Botanical Research on Pepper**

The earliest record of the description of piper in the Indian subcontinent was by Rheede. In his *Hortus Indicus Malabaricus*, 1678, the first printed document on plants of the Malabar Coast of India, he described five types of wild peppers including black pepper and long pepper. Linnaeus included 17 species from India in his *Species Plantarum*. Roxburgh described seven species of piper in Indian Peninsula. The first major study of the piper species of the Indian subcontinent was of Hooker *Flora of British India*. He divided the genus into six sections, namely: *Muldera*, *Cubeba*, *Chavica*, *Pseudochavica*, *Eupiper* and *Heckeria*. Black pepper is included in the section *Eupiper*.\textsuperscript{73} In *Theatrum Botanicum*, John Parkinson described that the king of Portugal prohibited selling of *Piper cubeba* (grown in Java and Sumatra, known as java pepper) in order to promote black piper (*Piper nigrum*) around 1640.\textsuperscript{74}

*Piper nigrum*, originated in Southern India (main centre was Malabar), was also found in Ceylon, Singapore, Penang, Borneo, Java, and Sumatra. *Piper longum* was found wild in Malabar and Coromandel Coast and also grew in Ceylon, Timor, and the Philippine Island. *Piper angustifolium* was found in Tropical America, Mexico, Panama, and Columbia.\textsuperscript{75} This name was, however, assigned to a very different plant, *Tetranthera apetala* (of Roxburgh), by William Jones. *Piper cubeba* was found wild in java, Sumatra, and Borneo, chiefly in coffee plantations. They were mostly exported from Java to Singapore. Melegueta Pepper (*Amomum*...)

\textsuperscript{72}The General Letter from The Court of Directors to madras dated 22 April 1789. “Having since received this information, and likewise the most favourable accounts of the Success of the Undertaking, we now order and direct that You assured Dr. Roxburgh every encouragement; and assistance in your power, in the cultivation of such useful Articles of our commerce, particularly that of Pepper.” Alexander Dalrymple, *Oriental repertory*, vol. 1-2 (London: 1793), p. 24.


\textsuperscript{74}Breverton, Terry, *Breverton’s Complete Herbal*, (London: 2011).

\textsuperscript{75} Official part and name Matica Folica, the dried leaves of Aranthe elongate.
melegueta) called “grains of paradise”, was carried to other tropical Countries and was grown in Guaiana (Demarara). Their principal consumption was in Great Britain and the United States for preparing cattle medicines.76

The Company financed travellers as well as self oriented explorers were mostly interested in the plantation techniques of different species of pepper. By the end of the eighteenth century, various publication discussed about the different species of pepper and their cultivation strategy. John Payne discussed about pepper, spices and the plantation in his book, Geographical Extracts, Forming a General View of Earth and Nature (London: 1796). John Payne described that three sorts of black pepper were available in the Island of Borneo- the first called Molucca, or lout-pepper, was the best. The second, named Caytongee-pepper was a middling sort; and the third, and worst sort, was Negaree-pepper, which was produced in great quantity. The cultivation of the pepper gardens was chiefly the employment of the Chinese who have settled in the Island.77

In France, the agents of the Ministry of the Marine and Colonies, and the Compagnie des Indes began to give serious attention to economic botany from 1740s. De la Bourdonnais and the Compagnie des Indes fostered experimental gardens in Pondicherry (in India), Mauritius, and Reunion Island, for the acclimatization of spices, dyes and drugs. By 1752, the Commander of Karikal (in south of Pondicherry), brought cinnamon to Mauritius and other spices arrived from Cochin China in 1759, along with pepper from Malabar.78 The French introduced the culture of pepper in Cayenne (capital of French Guiana). France during the American War forged a successful alliance with Spain and Holland. All this directly affected Britain’s Atlantic and Indian commerce, which was already complicated by the Dutch control.

76 For more details see Robert Bentley, Henry Trimen, David Blair, Medicinal plants, vol. 4 (London, 1880).
in the Cape. In this context, Britain had to take a serious program towards spice trade. George Smith (free merchant in Calcutta) presented Henry Dundas\textsuperscript{79} with a detailed financial plan to eliminate the need for paying for tea with silver by exporting metals, black pepper and other items. In this context, the cultivation of pepper started by the Company

William Roxburgh introduced pepper in the Samulcotta botanic garden (Northern Circar). The most particular orders were given to the Chief and Council of Masulipatam to furnish Dr. Roxburgh with all the necessary disbursements and to give orders to the zemindars. Instead of the real pepper-plant of Sumatra and the Coast of Malabar (\textit{Piper nigrum}), Roxburgh found a new species, \textit{Piper triocicum}.\textsuperscript{80} \textit{Piper triocicum} was equally good Pepper, but was more difficult to cultivate. Altogether, pepper plantation in Samulcotta was a failure, but it brought fame to Samulcotta. In some of the publications, Samulcotta was named only because of pepper plantation.\textsuperscript{81} As discussed in chapter II, according to Roxburgh, the cause of the failure of the pepper cultivation was to pick up a nearly allied species, while Benjamin Heyne discussed about the misappropriation of plantation technique. After all, the failure in Samulcotta opened the large study on pepper plantation.\textsuperscript{82}

Alexander Dalrymple, the hydrographer in the British East India Company, started his monogram \textit{Oriental Repertory}\textsuperscript{83} on pepper cultivation and the efforts of William Roxburgh. The East India Company granted £200 for the publication of this book. It explains the increasing demands and curiosity towards pepper. Further, Thomas Hibbert (1710-1780), an English merchant, brought the Malagueta pepper (\textit{Amomum granum} paradise) plant to

\textsuperscript{79} \textit{Ibid.}, Pitt and Dundas lent their hoping that the exploitation of Nature might supply food, raw materials, new ‘branches of trade and commerce’.
\textsuperscript{80} With hermaphrodite flowers that means female flower mixed on the same catkins.
\textsuperscript{82} William Marsden, \textit{The history of Sumatra} (London: 1811).
Jamaica from the East Indies in 1785. The first well documented information on Jamaican pepper appeared through Sir Hans Solane’s (President of the Royal Society, London from 1727-1741) remarkable journey to Jamaica (1687-1689). The full title of the two-volume account of this travel was *A Voyage to the Islands Madera, Barbados, Nieves, S. Christophers and Jamaica, with the Natural History of the Herbs and Trees, Four-footed Beasts, Fishes, Birds, Insects, Reptiles, etc. of the Last of those Islands*. It was the first traveller account which included illustrations, full Latin names and a detailed catalogue of the natural history and other artefacts. After coming from his voyage, Sir Hans Solane wrote an article on Jamaican pepper: *A Description of the Pimenta or Jamaica Pepper-Tree, and that bears the cortex Winteranus*. He wrote about pimento or allspice and described ‘it is as thick as a man’s thigh’. According to Sir Hans Solane, “this is the best, the most temperate, mild and innocent of all spices”. John Ray (1627-1705), the father of British natural history, also wrote about Jamaican Pepper tree.

After Roxburgh, William Hunter (Esq. M.D.) wrote an article on *Remarks on the Species of Pepper, which are found on Prince of Wales’s Island*. According to a review of this article, it seemed more highly valued than that which came from Sumatra, or the Malay continent. The article described five kinds of pepper: - (1) *Piper nigrum*; (2) *P. beetle*; (3) *P. siriboa*; (4) *P. chaba*; or *P. longum tigabe*; and (5) *P. latifolium*.

The correspondence among botanist of different part of the world created an intellect chain which served science as well as the colonial structure of knowledge. J. Hutchinson, Resident at Anjengo, sent some eight chests containing forty pepper plants through the

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85 This journey was well acknowledged because the introduction of milk chocolate in Europe by Sir Hans Solane.
Lieutenant Fortescue Commander of the *Syren Snow*. Alexander Anderson, superintendent of the Royal Botanic Garden at St. Vincent, was also tried to succeed in pepper plantation. He wrote to C. Taylor, Secretary of the Royal Society of London, about the poor situation of pepper plantation. As he wrote:

“East India Plants are more rapid in their growth, either from seeds or plants, than the indigenous plants of the country, and arrive at perfection sooner, but the reverse is the case with Chinese. I was pleased to see a specification of growth of trees in the East Indies by Dr. Roxburgh. I find those from India thrive full as well here as in their native soil.”

Alexander Anderson also communicated with Dr. Roxburgh for Pepper plantation. Vansittart, the Superintendent of the Dehradun (Deyrah Dhoon), also tried hard to get seed of black pepper. As the secretary mentioned that, through the kindness of W. Storm, he sent a small quantity of pepper seed to Vansittart.

Because of the continued botanical research on pepper, it did not remain a royal commodity. Along the Britain, America also became an important trader of pepper. Dutch started losing the grip over spice trade during Napoleonic War. After capturing the Dutch territories, mainly the Prince of Wales Island and Moluccas, the way for spice plants transplantation opened up. As it was mentioned:

“The advantage in prospect of transplanting into the Company’s territories the several spices produced in the Countries captured from the Dutch are so obvious that we make no doubt of the subject having already engaged your attention. But if in the variety of other matters this should have escaped your attention, we direct that you immediately take the necessary measures for introducing the most valuable of those spices into Bengal, Madras,

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89 Home Dept., Public Branch, 30th April 1788, No. 12.
92 See, *Journal of the Agricultural & Horticultural Society of India*, vol. iv, i (Calcutta, 1845).
Sumatra, and the Province of Malabar- acquainting us with your proceedings herein, and the progressive success of your experiments.”

**Nutmeg and Clove**

After the East India Company captured Moluccas and Prince of Wales Island, William Roxburgh was appointed as the Superintendent of the Company’s spice plantation in Sumatra. The government of the Madras Presidency appointed a commercial agent to the Spice Islands to supervise the spice monopoly. The anxiety over the transplantation was due to two reasons: first was the uncertainty over the control of that island during Napoleonic War; and the second was the high labor price in the islands. As it was mentioned:

“The price of labour at Amboyna and in the Moluccas Islands, generally as the different Residents can testify is at the rate of 10 Rupees per month for each and every man. Foreseeing, therefore, the great expense which must necessarily be incurred by the Company in collecting, rearing, taking care of, and dispatching to their various settlements in the Island.”

Company sent Smith to procure clove and nutmeg plants. Roxburgh gave a memorandum to Smith regarding the particular attention for Spice plants, as well on oil yielding plants, Timber, fruits, dyeing, fibres for cordage and cloths. Roxburgh also instructed to send the

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93 Home Dept. Public Branch, 20th March 1797, No. 5.
94 The conquest of the Moluccas was achieved by Admiral Rainier’s fleet on 16th February by obtaining the surrender of Amboina (Ambon Island) and its dependencies without resorting to violence. The agreed terms of surrender are those offered by the Prince of Orange in his letter to Governors of Dutch colonies (The letter referred to in the Europe chapters that was required of the Prince as a term of his protection in England – it directed colonial governors to accept British garrisons in their ports, etc., for the duration of the war). The fleet sailed from Malacca on 6th January after that place was conquered but a French squadron in the Banka Straits caused Rainier to put back for reinforcements. He then set out again on 18th January. The Orpheus captured a small Dutch brig near Banka that had been sent out from Batavia to investigate the progress of the British invasion. On 16th February Rainier arrived off Amboina and sent the Prince of Orange’s letter ashore which was accepted. The grenadiers landed next morning and the British flag was raised above the fort. On 4th March Captain Gordon was left in command and the squadron sailed on to capture Banka Island which contains the famous tin mines. Saturday 9th July 1796, http://www.houghton.idv.hk/?p=175, accessed on 27th May, 2015.
97 Home Dept. Public Branch, 9th June 1803, No. 16.
plants to Bengal, Madras, and to Dr. Heyne, the Companies botanist on the Coast at Samalkot. As the several verities of clove and nutmeg plants were available in Moluccas, it was desirable to procure original nutmeg and clove plants. Roxburgh suggested Sonnerat name through whom Smith can get some botanical help and provided some of the plants’ morphology in the memorandum. For example, Roxburgh wrote that Nutmeg had mainly two verities- the *Myristica moschata* and *Myristica tomentosa*. Since Roxburgh had never visited Moluccas, his information was based on oral contemporary sources and Rumphius description. Nutmeg was grown spontaneously in the Moluccas Islands, but it was chiefly cultivated in Banda and in other neighbouring Islands. In all other Moluccas Islands, the Dutch had destroyed and rooted up the trees bearing nutmegs. The culture of nutmeg did not succeed in the French African Islands, but was found to grow luxuriantly in the settlement of Cayenne.

For clove *Eugenia caryophyllata* was the best known species. It was particularly found in one of the Islands named Maekian. From Maekiawhere, the young trees of clove were transplanted into other neighbouring Islands, like Amboina,\(^99\) where it was cultivated with great industrial attention. The Dutch also forcefully rooted up clove plants from other parts and concentrated its cultivation in small neighbouring Islands – Oma, Housoma or Honi-oma, and Nussalauto. In spite of all measures taken by the Dutch to restrict the clove plant in certain area, they failed to prevent the introduction of the clove trees in other places. In the year 1770 French circumnavigator found clove and nutmeg trees in New Guinea.

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\(^99\) Amboina was famous for its production of nutmeg and sago. The nutmeg tree is similar to a small mango. Sago comes from a palm tree like the coconut. It is produced from the pith of the fruit by a process we learned from the natives. Saturday 19\(^{\text{th}}\) June 1802, [http://www.houghton.idv.hk/?p=175](http://www.houghton.idv.hk/?p=175), Accessed on 27\(^{\text{th}}\) May, 2015.
New Guinea, French transplanted these plants to their colony in the Isle of France and Island of Cayenne.\textsuperscript{100}

In 1801, Roxburgh described three distinct collections of plants from Amboina that had reached to Calcutta Botanical Garden by ship \textit{Union}. As Roxburgh Described:

"1) the first was received in may 1797 when the ship was commanded by Capt. M. Call and consisted of between four and five hundred small healthy nutmeg plants and about as many more in a sticky state, many of them are still in the Botanic Garden and are from two to six feet high and except very few received by the Capt. Nash from \textit{Cartier}, the month before april 1797, they were the first plants of this spice received into Bengal.

2) The second collection by the \textit{Union}, Capt. Sparrom, was received in April 1798, when I was absent at the Cape of Good Hope on account of my health. It consisted of only 197 nutmeg plants in a tolerable health and sticky state. The whole of the clove plants perished on the passage. Several chests of other plants, specified by their Malay name only, were also at the same time, shipped on the \textit{Union}, but no better luck attended them than attended the cloves. So that of this extensive collection the above mentioned few nutmeg plants are all that reached this garden in any tolerable condition.

3) The third collection by the same ship and same commander was received on the 29\textsuperscript{th} June 1799 and consisted only 60 Gumottoo (Saguerees Rumphii) and four sticky clove plants since dead. What number were shipped this time, no account has reached to the Botanic Garden.\textsuperscript{101}

Again Roxburgh wrote on 30\textsuperscript{th} March 1802:

"to inform the President in Council that we are still without a single clove plant in any of the Honble Companies possession, except Prince of Wales Island, and but few of the Nutmeg trees at Bencoolen, where they thrives well, and not any of either on Ceylon...i have just informed that it is the intention of His Excellency, the Honble

\textsuperscript{100} Memorandums for Mr. Smith (by Dr. Roxburgh) on his departure for Prince of Wales Island, Malacca and the Spice Islands, Home Dept., Public Branch, ‘A’, 22\textsuperscript{nd} May, 1797, No. 17.

\textsuperscript{101} Letter from William Roxburgh to C.R. Crommelin, Secretary to the Government in the Public Department. Home Department, Public Branch, 8 October, 1801, No. 45.
T. North, the governor of that Island, to apply to the government for as many thousand plants of each sort, conveniently be procured, before the restoration of the Moluccas.”

Roxburgh went to the Prince of Wales Island to assist in transplantation. British were particular about the transplantation of plants from Price of Wales Island. It is evident from these lines:

“Notice for the governor of the Prince of Wales Island that as soon as possible please give attention to the immediate transplantation of the spice plants growing upon the Island and to the keeping in Boxes, until W. Roxburgh return to the Island, the nutmeg and clove plants with which W. Smith was daily expected to arrive from the Moluccas, that they may upon Roxburgh’s return be sent to the several places recommended by the Superintendent who has been directed to issue the instructions proposed in his letter to his assistant W. Roxburgh.”

Roxburgh suggested to set up a small establishment under a European gardener at Prince of Wales Island and sent some of the nutmeg and clove plant, procured by Smith from Moluccas.

**Slave Food and the Breadfruit**

Slave trade was one of the lucrative trades since the sixteenth century. Spain and Portugal introduced slaves into the plantation economy including sugar, indigo and coffee. By the mid of the eighteenth century, Britain became the foremost slave trader (see the table). Slaves were very costly due to the long route and high mortality rate during sea voyages. Plantation owners exploited them as much as possible to get their investment returned. Slave owners got profit many times more than their investment by following the exploitation and brutality.

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102 Home Dept., Public Branch, 1st April, 1802, No. 47.
103 From Fort William, Home Dept., Public Branch, 19th August, 1802, No. 48.
104 Letter from William Roxburgh to Sir John Shore, Governor General in Council, Home Dept., Public Branch, 22nd May 1797, No. 16.
to slaves. Slave owners were very conscious about cheap, yet nutritious staple food for slaves. Slaves received the food or ration by two ways: first, plantation owners gave a unused piece of land to cultivate their own food. However, the unused area was often of poor quality, mountainous or stony and often at some distance from the villages. And the second way was rationing different staple food- corn, plantain, salted fish to the slaves. In the sugar plantation area, every inch of land was profitable so the food rationing was the cheaper option. The rationing system was also applicable in the time of drought, grain failure, or war. The plantation owners preferred to import food, mainly by sugar plantation owner, items like corn, salted herrings and beef from North America, while occasionally horse beans and biscuit bread from England were imported. With the outbreak of the American Revolution in 1776, the trade stopped between North America and the British Islands in the West Indies and the other resources of slave’s cheap staple food. Breadfruit became popular in this search of staple food for slaves.

Breadfruit is a large, hard, pock-skinned fruit with a flavour reminiscent of artichoke. It grew in many places across Southeast Asia and the pacific. It was a tropical staple food. It did not had quality to cure ill health, soothe nerves, and help to preserve other foods, or even add spice to a dish, yet the British government, prompted by a wide range of interested and influential people, decided to collect breadfruit as any of the valuable spices by the mid-eighteenth century. The purpose of bringing breadfruit to the West Indies was to provide a cheap staple for the slaves in the British islands. A description of a fruit that could act as a substitute for bread was published in England in 1697. William Dampier compendium of his voyages had an appendix of the plants and creatures, which included “The Bread-Fruit”, from

Sir Joseph Banks and others saw the value of breadfruit as a highly productive food in 1769, when he was stationed in Tahiti, as part of the *Endeavour* expedition commanded by Captain James Cook. The late eighteenth century quest for cheap, high-energy food sources for slaves in British colonies prompted colonial administrators and plantation owners to call for the introduction of Bread-Fruit to the Caribbean. The President of the Royal Society, Banks provided a cash bounty and gold medal for success in this endeavor, and successfully lobbied his friends in government and the Admiralty for a British Naval expedition. In 1787, William Bligh was appointed Captain of the HMS *Bounty*, and was instructed to proceed to the South Pacific for this task. Banks appointed a gardener for the

Table: 3.3 Trans-Atlantic Slave Trade

<table>
<thead>
<tr>
<th>Year</th>
<th>Spain / Uruguay</th>
<th>Portugal / Brazil</th>
<th>Great Britain</th>
<th>Netherlands</th>
<th>U.S.A.</th>
<th>France</th>
<th>Denmark / Baltic</th>
<th>Totals</th>
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</thead>
<tbody>
<tr>
<td>1501-1525</td>
<td>6,363</td>
<td>7,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>13,363</td>
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<tr>
<td>1526-1550</td>
<td>25,375</td>
<td>25,387</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>1551-1575</td>
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<td>31,089</td>
<td>1,685</td>
<td>0</td>
<td>0</td>
<td>66</td>
<td>0</td>
<td>61,007</td>
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<tr>
<td>1576-1600</td>
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<td>90,715</td>
<td>237</td>
<td>1,365</td>
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<td>0</td>
<td>0</td>
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<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>1626-1650</td>
<td>44,313</td>
<td>201,609</td>
<td>33,695</td>
<td>31,729</td>
<td>824</td>
<td>1,827</td>
<td>1,053</td>
<td>315,050</td>
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<tr>
<td>1651-1675</td>
<td>12,601</td>
<td>244,793</td>
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<td>1676-1700</td>
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<td>272,200</td>
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<td>3,327</td>
<td>29,484</td>
<td>25,685</td>
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<td>474,447</td>
<td>410,597</td>
<td>73,816</td>
<td>3,277</td>
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<tr>
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<td>554,042</td>
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<td>34,004</td>
<td>259,095</td>
<td>4,793</td>
<td>1,471,725</td>
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<tr>
<td>1751-1775</td>
<td>4,239</td>
<td>528,693</td>
<td>832,047</td>
<td>132,330</td>
<td>84,580</td>
<td>325,918</td>
<td>17,508</td>
<td>1,925,314</td>
</tr>
<tr>
<td>1776-1800</td>
<td>6,415</td>
<td>673,167</td>
<td>748,612</td>
<td>40,773</td>
<td>67,443</td>
<td>433,061</td>
<td>39,199</td>
<td>2,008,670</td>
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<tr>
<td>1801-1825</td>
<td>168,087</td>
<td>1,160,601</td>
<td>283,959</td>
<td>2,669</td>
<td>109,545</td>
<td>135,815</td>
<td>16,316</td>
<td>1,876,992</td>
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<tr>
<td>1826-1850</td>
<td>400,728</td>
<td>1,299,969</td>
<td>357</td>
<td>1,850</td>
<td>68,074</td>
<td>0</td>
<td>1,770,979</td>
<td></td>
</tr>
</tbody>
</table>


108 Although the Trans-Atlantic Slave Trade Database includes all slave voyages that have been documented up to now, it cannot claim to be complete. Records of many voyages have disappeared, in some cases irretrievably, while other documents remain to be discovered in public and private archives. The “Estimates,” on the other hand, provide an educated guess of how large the slave trade actually was. Altogether, the estimates are about 25 percent higher than unadjusted numbers in the main database. They raise the final totals to over 12,500,000 Africans forced to undertake the Middle Passage and around 10,700,000 who completed it, the largest forced migration in modern history. [http://www.slavevoyages.org/tast/assessment/index.faces](http://www.slavevoyages.org/tast/assessment/index.faces)
expedition and gave detailed instructions on how the plants to be maintained. Whereas the
King, upon a representation from the merchants and planters interested in His Majesty's West
India possessions, thought fit that measures should be taken for the procuring some of those
Bread-Fruit trees, and conveying them to the said West India islands.\footnote{By the Commissioners for executing the office of Lord High Admiral of Great Britain and Ireland, &c. to Lieut. Wm Bligh, commanding his majesty's armed vessel the Bounty, at Spithead, 20th November 1787. http://law2.umkc.edu/faculty/projects/fltrials/Bounty/blighorders.html} Sir Joseph Banks, with the endorsement of Evan Nepean, Under Secretary of the Home Office, was responsible for preparing plans for a voyage to transport breadfruit from the East Indies to the West Indies. The administrative arrangements involved him in procuring, equipping and fitting out a suitable vessel, HMS Bethia renamed HMS Bounty, for the voyage. Banks was also responsible for preparing official instructions for the voyage. The original plan directed that a vessel be detached by Governor Arthur Phillip from the colony at New South Wales to procure breadfruit and other useful plants from the East Indies and flax plants from New Zealand. Later the plan was revised, which resulted in the outfitting of a separate expedition direct from England, under the command of William Bligh.\footnote{Series 45: 'Plan for the Voyage with Letters from various persons who interfered in the management of it', being papers concerning preparations for the breadfruit voyage of HMS Bounty, William Bligh, 1787. http://www2.sl.nsw.gov.au/banks/series_45/45_view.cfm, accessed on 1st January 2015.}

The Bounty remained in Tahiti for five idyllic months, during which over 1000 plants were collected, potted and transferred to the ship. However, within a month of leaving, many of the crew mutinied and expelled Captain Bligh. Bligh survived the ordeal and in 1791 commanded a second expedition with the Providence and the Assistant, which collected live breadfruit plants in Tahiti and transported to St Helena, in the Atlantic, and St. Vincent and Jamaica in the West Indies. The annual Portuguese ship from Timor, which had arrived at Batavia, reported that Captain Bligh had visited Timor from Otaheite, on 2nd October 1792,
with 1,800 breadfruit plants and some other exotic vegetable. Although Bligh won the Royal Society medal for his efforts, the introduction was not entirely successful, as the slaves refused to eat breadfruit. However, breadfruit was accepted into the cuisine of Puerto Rico.

During the dreadful famine of 1791-93, which reduced the population of the Northern Circars to nearly one-half, Roxburgh suggested the Government of Madras, for the introduction and extensive cultivation of all such vegetable products which can supply food to the natives when the rice crop fails. Roxburgh was even very particular to procure the breadfruit tree from the Nicobar Islands, and a fruit called Mellore, which was supposed to be infinitely superior to the breadfruit. Mugalik was the Telinga name of the male plant of Mellore, and Gozdoogoo that of the female. Kaldera was the name by which Europeans known this fruit. The drawing of the Mellore, or breadfruit of the Nicobar Islands, was drawn in the third volume of the Asiatic Researches, by Colonel Kyd. Roxburgh send the Bread-Fruit plant to the Governor of Madras E. J. Holland. The letter from Dr. A. Anderson to Dr. William Roxburgh, concerning the climate and productions of the Travancore Country, was the account of the Bread-fruit trees. In these ways, Roxburgh also contributed in the cultivation of Bread-fruit tree.

Potatos

113 Also see, William Roxburgh, William Carey, Flora Indica or Description of Indian Plants, Vol.III, (Serampur: 1832) p.738.
There were various reasons behind the promotion of potato cultivation. Potato was suitable as a food item of slaves and could have been used during the war, famine and grain failure to feed the increasing population of Europe. William Roxburgh brought attention on the importance of its cultivation during tough times. The discussion on the potato plantation started by the early eighteenth century as reflected in the *A discourse Concerning the Improvement of the Potato*. But the discussion on the origin of this root specie (potato) started in the end of the eighteenth century by the prominent botanist including Joseph Banks, Dryander, and Benjamin Smith Barton. They discussed the importance of this root in the time of war. Joseph Banks wrote a paper *An Attempt to Ascertain the Time When the Potato (Solanum tuberosum) Was First Introduced into the United Kingdom,...* In this paper, Joseph Banks argued that the origin of seed potato (a potato that is intended for replanting to produce a new plant) of England came from the Virginia. As he wrote:

“The potato now in use (Solanum tuberosum) was brought to England by the colonists sent out by Sir Walter Raleigh, under the authority of his patent, granted by queen Elizabeth, ‘for discovering and planting new countries, not possessed by Christians,’ which passed the great seal in 1584. Some of Sir Walter’s ship sailed in the same year; others, on board of which was Thomas Herriot, afterward known as a mathematician, in 1585; the whole, however, returned, and probably brought with them the potato, on the 27th of July, 1586.”

But to criticise the Banks’ argument, Benjamin Smith Barton also wrote a paper entitled as “*On the Native Country of the Solanum tuberosum, or Potato*”. In this paper, Barton gave enough proof that the Spain brought potato in the region Virginia and origin of that seed potato could be in Chili or Peru, or from the Kingdom of New Granada, because potato was

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unknown to Mexico before the arrival of Spaniards (Spain). John Dryander also described all published materials, till 1797, on potatoes. Adam Smith, in his Wealth of Nations, published in 1776, described maize and potatoes as ‘the two most important improvements which the agriculture of Europe... has received from the grat extension of its commerce and navigation.’

After Roxburgh’s suggestion East India Company specially appointed Benjamin Heyne, Superintendent of the Botanical Garden of Bangalore, for the potato cultivation.

**Plants for tanning** and Dyeing

The worldwide sea trade in the sixteenth century boosted the long-distance transfer of dyes. The different applications of dyes developed textile industries substantially. The superior quality and larger available quantities of certain regional dye sources, most notably the Indian species of the indigo plant and the American species of the cochineal insect, immediately attracted merchants and textile producers. Important natural dyes were Cochineal for deep crimson colour with greater ease than dyes made from kermes and lac.

Access to the large quantities of foreign dyestuffs stimulated the transformation of the European textile industry into a truly global commercial network. Beginning in 1565, the fleet of Spanish ships, *Manila Galleons*, opened trade across the Pacific, sending silver mined in the Americas to Asia, where it was exchanged for Chinese silks and other goods. The silk was then shipped via the Philippines to Mexico, Peru and to Europe. Silk, which was easy to

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124 The term tannin (from *tanna*, an Old High German word for oak or fir tree, as in Tannenbaum) refers to the use of wood tannins from oak in tanning animal hides into leather; hence the words “tan” and “tanning” for the treatment of leather.
dye with an array to dyestuffs, arrived in Europe and Latin America either as undyed raw silk, cloth, or thread.\textsuperscript{125}

Until the second half of the nineteenth century, when synthetic dyes were developed, the dye demand was fulfilled from natural sources. Natural dyes can be divided into two categories substantive and adjective. Substantive, also called as direct dyes, became chemically fixed to the fibre without the aid of any other chemicals or additives, such as indigo. Adjective dyes required some portion of substances, usually a metal salt, to prevent the colour from washing. Most natural dyes were adjective in nature. Plants were also used as mordants, especially those who had a natural ability to extract such minerals from the soil. These dyestuffs started from plants whose roots, leaves, and flowers were employed for colour, such as madder, weld or indigo. Certain animals were also very important dyestuffs, like cochineal insect, which produced a large of brilliant reds, Murex genus of marine snails and related species, which had a gland since antiquity to make the famous Tyrian (or Royal) purple. Kermes\textsuperscript{126} (Kermes vermilio) a small insect that lives on the kermes oaks of the mediterranean coastal shrublands, was a primary source of red dye for much of the Europe till the renaissance.\textsuperscript{127}

The main aim of the imperial botanists was to discover the plant which can served many purposes, like of medicinal, dying and tannin. As an examplee, the tree \textit{Diospyros malabarica} bark and the unripe fruit had medicinal uses in Ayurveda practices. At the same time, unripe leaves and fruits were traditionally used to dye cloth as black in colour.

\textsuperscript{126} Romans valued most highly the colour obtained from the Kermes, \textit{Coccus illicis}. Pliny mentions that this dye was sometimes employed with the colour of murex and buccinum, (the shell-fish which gave the Tyrian purple) in producing a sort of purplish crimson, called by the Romans \textit{hysginus}. For detail see \textit{The Edinburgh Encyclopedia Conducted by David Brewster with the Assistance of Gentlemen Eminent in Science and Literature}, (Philadelphia: Joseph and Edward Parker, 1832). p.37.
Diospyros malabarica was named in Roxburgh Plants of Coromandel Coast as Diospyros glutinosus. The tree exuded a glutinous substance used for caulking and sealing boats in the traditional way. The unripe fruit was rich in tannins and used for curing nets, leather etc. Roxburgh described this plant in his letter\textsuperscript{128} to Dr. C. Taylor. He sent the extract of fruits of the plant for the purpose of dying and tannin. The demand of dye bound Europeans to see alternative resources.

Roxburgh started his interest in dye from Samalkot, where James Anderson had conducted research on Cochineal insects. Roxburgh published on cochineal and then started research on indigo. In 1807, in his correspondence with the Society of Arts, through the medium of Dr. Charles Taylor, the new secretary, Roxburgh discussed about the extract of the Gaub, or Tannin, prepared from the fruit of the Diospyros-Glutinosus. In June 1804, Roxburgh introduced *Mimosa Arabica*, as a substitute for Aleppo galls. Upon the leaves of the tree which produced the yellow Myrobolans, he found an insect replete with a bright yellow colour. Roxburgh was inclined to think “that they might prove as valuable a yellow dye, as the cochineal is a red.” He also recommended to the Society about:

\textquotedblleft 1) Certain resins, commonly called Dammer, which when boiled up with oil, were used instead of pitch in the marine yards of India.

2) A drying oil, extracted by incision, from the *Oleoxylon Balsamifera*, which grown abundantly in Chittagong, and was used chiefly in painting.

3) Vegetable substances, containing the tanning and astringent principles.\textquotedblright\textsuperscript{129}

Some of the important natural dyes were researched by Roxburgh and he also published papers on them.

**Cochineal**


In 1519, Spain’s conquistadors found the Aztecs selling an extraordinary red dyestuff in the great market of Mexico. Calling the dyestuff Grana cochinilla, or cochineal, the conquistadors shipped it back to Europe, where it produced the brightest, strongest red the old world had ever seen. As far as Europe was concerned, the only trouble with cochineal was that Spain controlled the supply. Indeed, Spain guarded its monopoly so jealously that the dyestuff’s very nature remained mystery. More than two century the other part of Europe was in dilemma that whether cochineal was an animal, vegetable or mineral.¹³⁰

In the third volume of the *Philosophical Transactions*, 1668, cochineal was supposed to be an insect “engendered” by the fruit of the prickly pear.¹³¹ Since then, many papers were published in the *Philosophical Transaction* to understand the nature of cochineal. In 1672, 1691, 1693, and 1704, *Philosophical Transaction* published papers regarding this subject.¹³² About the year 1730, Dr. Rutley, then Secretary of the Royal Society, published a Natural History of Cochineal (in the XXXVI vol. of the Transactions), where he described these insects as ‘small living animals with a beak, eyes, and feet’. Not long after this, Reaumur, in his *Histoire des Insects*, and Dr. Brown, in his *History of Jamaica*, described the female Cochineal with sufficient accuracy.¹³³ The attraction towards the red colour and the search for the alternative source of cochineal compelled imperial collectors and botanists to look further.

In India, botanists were concentrated on cochineal production and distribution. Dr. James Anderson firstly brought the attention on the different species of *Coccus* found in

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¹³² For the details see Transactions of the Agricultural and Horticultural Society of India, Vol. VI, (Calcutta: 1839), Appendix, p.13.
Madras region. He sent the sample to the Joseph Banks in 1786 and Banks agreed that it was not cochineal but might be an acclimatized form. Soon the directions were accordingly issued for the introduction of both the insects and plants, on which it could be feed. Court of Directors instructed in April 1788:

“The supposed discovery of Dr. Anderson in the environs of Madras, which, although unsuccessful in the issue, has, nevertheless, led your Committee to conceive that the Insect may very successfully be introduced and propagated in the British nation, by giving to the former a new article of culture, to the second an additional article of commerce, and to the latter a participation in a lucrative article of Trade, which has hitherto been enjoyed unrivalled by a neighbouring power.”

Anderson was permitted to establish a garden to be called the Company’s Nopalry, for the cultivation of the several kinds of Cactus, on which alone the true cochineal feeds. Anderson placed Dr. Berry as superintendent. In June, 1791, Dr. Anderson ascertained that the Nopal plant was in a thriving state at St. Vincent’s, in the West Indies, and on the Island of St. Helena. He therefore suggested “the practicability of establishing the Cochineal insect from Mexico at St. Vincent’s, of conveying it thence to St. Helena, and afterwards to India.”

When Roxburgh was in the Calcutta Botanical garden then cochineal insects were ultimately successfully conveyed to Bengal by Captain Neilson from Brazil in 1795. The insects were given to Dr. Dinwidie for the experiments. James Dinwiddie, then the Professor of Natural Philosophy in the College of Fort William in Bengal, submitted a report:

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135 “Measures which have been pursued by the Court of Directors and the Governments in India, with a view to the introduction of the True Cochineal Insect into the British Territories in India.” Extract from the India-House Records, in the book *Transactions of the Agricultural and Horticultural Society of India*, Vol. VI (Calcutta: 1839), p. 85 (Appendix).
“Our new manufacture of cochineal thrives astonishingly, and will, I hope soon render the importation of that drug from Mexico unnecessary. I was employed by the Governor-General in Council to examine the Bengal cochineal; I find it of the second, or Silvestris kind, but pretty high in that class. The colouring matter is equal in quality to the very best Spanish mestique, with which I compared it, and the quantity of colouring matter was to that of the mestique as 10 to 19.”

A portion of the Cochineal insects was brought by Captain Neilson and was forwarded to Madras. Within three years, there were two thousand Opuntia plants, species of cactus, growing in the garden. Anderson sent this particular plant to various parts of India, which is evident from his correspondences *Communications from October the 1st, until the 12th of December 1795* (Madras: 1795). Latter, Roxburgh and Anderson both sent their cochineal specimens to the Court of Directors, and Directors observed:

“The Specimens of Cochineal forwarded by Dr. Roxburgh and Mr. Faswell, as also two parcels sent from the Coast by Dr. Anderson and Dr. Berry...all agree, that it is the *Silvestre*, or wild species, and that there is little prospect of its being cultivated to any advantage for the supply of the European market, unless it could be afforded at about one-third of the price of the *Grana Fina*, or at from 5s. to 6s. per pound, freight and all charges included.”

The Court also directed the Bengal Government that they should not engage in any measure that might lead to expense. Meanwhile English merchants were also refusing to buy that quality in high price. The progressive deterioration in the value of Cochineal within the first three years, from 1797 to 1799, of its importation, compelled company to think for shutting down the garden expenses. The price fall from 19s 4d. per lb. to 8s 8 1/4d. 138 By the

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138 “Measures which have been pursued by the Court of Directors and the Governments in India, with a view to the introduction of the True Cochineal Insect into the British Territories in India.” Extract from the India-House Records, in the book *Transactions of the Agricultural and Horticultural Society of India*, Vol. VI (Calcutta: 1839), pp. 88-90 (Appendix).
1800, along with Samulcotta Botanical Garden, Nopalry Garden was also closed. In these way, this effort was also a failure like pepper plantation. However, during the same time considerable attention was also directed to the culture of the Mulberry, Silk Worm, and the transactions of Mauritius Cotton Seeds and Brown Cotton Seeds. So, in this respect the research was not a complete failure.

**Indigo**

From the seventeenth century, Spaniards, Portuguese and French took interest in the culture and manufacture of indigo. Spaniards introduced the indigo plants in Mexico, Portuguese in Brazil and French in St. Domingo. British were dependent on these countries for the supply of finest kind of indigo. But, about 1779-80, the Court of Directors, East India Company, decided to make extraordinary efforts to increase the production of Indigo. The earliest effort was done by John Prinsep, an indigo merchant, who wrote to Lord North on 25th January 1780 that the “objects of introducing Indigo, Sugar, and Tobacco into Great Britain from the East India.”

In Southern part of India, Koenig tried to get a good quality of *Indigofera*, as William Jones described. Koenig was popular in the circle of British naturalist due to his efforts for indigo. He discovered two important species *Indigofera fragrans*, and *Indigofera linifolia*. Roxburgh got attracted with indigo plants due to the Koenig efforts. Roxburgh got the information about the species of indigo leaves from Dr. Patrik Russel. Patrik Russel wrote to Roxburgh from England that:

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“Among the papers of the late G. Cambell, who was a surgeon on the Madras establishment, and died of wounds received in the battle between colonial Baillie’s detachment and Haider Ali, in 1780, there was found mention of the tree, and that the natives made indigo from its leaves.”

In 1790, Roxburgh discovered a species of indigo called *Nerium indigo*. The extract of the light blue colour was somewhat similar to *Indigofera tinctorium*, the most common indigo plant used by Indians. After enquiring about two years, Roxburgh came to the conclusion that the particular species *Nerium indigo* was not in use. After research on this particular species, Roxburgh wrote a letter to E. Hay, on 8th June, 1790, from Samulcotta. He mentioned that:

“On St. Helena and the West Indian Islands, there is great abundance of soil and situation favourable to the culture of this tree...It has been ascertained that the natives of Vizagapatam and Ganjam, and also of other districts in Carnataka, have been long acquainted with the quality of its leaves.”

Roxburgh sent first sample of *Nerium indigo* to Colonel Robert Kyd and second to the Court of Directors through the ship *Houghton*. This quality of indigo dye from the *Nerium indigo* was equivalent to Guatimala indigo. The Royal Society accepted these measures and wrote that- “in the year 1786, Great Britain was almost dependent upon Spain and France for the indigo. From East Indies, the import of this article was being only £57,002 in value. But because of the subsequent encouragement and discovery in East Indies, the value increased to £1,105,678 by the 1809.” The indigo plant was introduced from Sumatra into the East India

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145 William Roxburgh, Flora Indica or Description of Indian Plants, Vol. III (Serampore: 1832), pp. 378-379.
Company’s botanic garden, at Calcutta, in 1793. After that Hamilton Buchanan also brought the indigo plant from Pegu (now called Bago region in Myanmar), to Calcutta Botanical Garden in 1795. But, Hamilton Buchanan’s species was different and

**Figure: 3.2 View of the *Nerium indigo* Works as Participated at Hindostan**

![View of the Nerium Indigo Works as Participated at Hindostan](image)


Figure: 3.3 *Nerium tinctorium*, Sent by William Roxburgh to the Court of Director\(^{151}\)

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Roxburgh named it as *Asclepias tingens*. This plant failed to give intense colour, because of the lack of sufficient information on cultivation.\(^{152}\)

### Chay Root, Sappan Wood and Lac-Dye

*Oldenlandia umbellata* root, commonly known as Chay Root or East India Madder of the English, was used in dyeing. Roxburgh did more than two or three hundred experiments for enabling himself to dye red. Different colour was obtained by the natives through this root. Red, purple, orange, brown were the prominent colour which was obtained with the root and Roxburgh elaborated all the dying steps. It was noticeable that he focused on Chay Root more than any other plants in his book *Plants of the Coromandel Coast*.\(^{153}\)

*Caesalpinia sappan*, was Buckan-chitto of the Telingas; and Sappan Wood tree of the English. It was originated in the south-west frontier of the Bengal province. The markets over India were supplied with wood from Siam, and the Malay countries to the eastward. Roxburgh had some thousand of young trees about the Company’s pepper plantations, which thrived well. The colour of the wood improves by the age, and ought therefore to be left till the colour attained to its utmost degree of perfection. The uses of this wood in dyeing are numerous throughout Asia. It was an ingredient in the red dye of this coast, commonly called the chay dye. The cheap red required for cotton cloth Telinga dyers was taken from this wood.

Lac is a colouring matter, of animal origin, having a colour more or less red. Lac-Dye was extensively used for dyeing red or scarlet colour, as a cheap substitute for cochineal. It was produced in India by the *Coccus Lacca*, a small winged insect. The natives of Assam used it as a dye. As an article of commerce, lac was known in Europe under the application

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\(^{153}\) *Plants of the coromandel coast*. Vol 1.
Figure: 3.5 Sappan Wood (Caesalpinia sappan)


Figure: 3.6 Chay Root (Oldenlandia umbellata)

of stick-lac, seed-lac, and shell-lac. It was discovered in the interior of India. Stick-lac was the gum, with the insect, or the egg of the insect in it, from which the lac-dye was made. The dying particles were separated from the gummy particles, and the gum was made into shell-lac. Lac-dye was used in the dyeing of scarlet cloths, as a substitute for cochineal, but was not used/adapted for the finest dyes. The lac was employed very much as a varnish.\textsuperscript{154} Roxburgh got this insect from James Anderson in 1789, to examine this little creature. Roxburgh sent his detail study to Anderson and he sent this study to William Jones, on the 2\textsuperscript{nd} January in 1790, for the publication in Asiatic Researches. This paper was published for the second volume of the journal in 1799 entitled as “On the Lacsha or Lac Insect”.\textsuperscript{155} Because of much appreciation of the culture of this insect the import value raised within two decades.

The quantity of lac-dye and of shell-lac imported into Great Britain in 1814 and 1828 was as follows:\textsuperscript{156}

<table>
<thead>
<tr>
<th>Year</th>
<th>1814</th>
<th>1828</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lac-Dye</td>
<td>lbs. 278,899</td>
<td>lbs. 728,240</td>
</tr>
<tr>
<td>Shell-lac</td>
<td>lbs. 110,670</td>
<td>lbs. 461,477</td>
</tr>
</tbody>
</table>

\textbf{Figure: 3.7 Drawing of Lac Insects by Roxburgh}


\textsuperscript{154} Appendix to the Report from the Select Committee of the House of Commons on the Affairs of the East-India Company, 16\textsuperscript{th} August 1832, (London: 1833), p.631, pp. 361-364.

\textsuperscript{155} Lacsha name add by Jones for the title because as he observed Hindu generally called it Lacsha. \textit{Asiatic Researches or, Transactions of the Society Instituted in Bengal}, Vol. II (London: 1799).

\textsuperscript{156} Appendix to the Report from the Select Committee of the House of Commons on the Affairs of the East-India Company, 16\textsuperscript{th} August 1832, (London: 1833), p.689.
Tanning

The manufacture of leather and leather goods was, by value, the most important industry, after textiles. Between 1680 and 1830, this industry consisted one of the largest employers of labour outside the agriculture. Roughly 90 per cent of all leather was tanned with oak bark.\textsuperscript{157} The prices of oak bark rose very gradually from the 1750s and sharply after 1790. The consumption of bark increased at an accelerating rate and by the 1790's a serious shortage had emerged.\textsuperscript{158} During the Napoleonic Wars, when the demand of leather rose in response to military requirements, bark prices rose more than threefold.\textsuperscript{159} As demand increased there was a search for substitutes of bark. Alexander Anderson\textsuperscript{160} also wrote in a letter:

“You mention the high price of oak bark for tanning. I am confident we have many barks here superior to it. As to astringent principle, whether our bark in tanning deserves experiment. For the end I will transmit you some specimens by the first opportunity”.\textsuperscript{161}

In the preface of transaction of the Society, Instituted at London, for the Encouragement of Arts, Manufactures, and Commerce, discussed the need for substitute of oak bark in the year 1805.


\textsuperscript{158} After 1750, the combined effects of population growth and an increasing demand for leather from agricultural and industrial expansion brought the rate of growth of leather production closer to the growth of total output. Taking English, welsh, and Irish consumption together, the total demand for bark during the 1720s and 30s fluctuated between 55,000 and 60,000 tons a year, falling during the late 1730s and 1740s, but rising again during the next twenty years to about 70,000 tons by 1764. A brief fall in demand in the second half of the 1760s was followed by generally increasing demand during the 1770s and 80s until, in the early 1790s, it stood in the region of 80,000 tons a year. \textit{Ibid.}, pp. 337-339.


\textsuperscript{160} He was superintendent of the Royal Botanical Garden at St. Vincent.

“The present scarcity of oak bark, and the too frequent mischief arising to oak timber, from its destruction for the bark, induced the society, a few years past; offer a premium for a substitute to answer the same purpose, in tanning leather.”

At the end of the eighteenth century, naturalists were engaged to search substitute species, and chemist were looking for achieving right composition for tanning. William Roxburgh discovered many plants and fruits, whose chemical composition was suitable for tanning. *Terminalia Belerica*, described in *Flora Indica*, was largely employed in India for dyeing and tanning and its fruit was exported from India under the name of myrobalans. *Uncaria Gambier* was a highly valued for tanning purposes in Europe, because it imparted softness to the leather.

William Roxburgh argued that the idea of tanning cordge was not new for the Asian as well as of European fishermen. They not only tanned their nets and lines, but also strengthened their sails and made them more durable. He wrote:

“We know the tanning principle strengthens the fibers of lether, (animal fibers); but are not so clear that its operation on vegetable matter is uniformaly the same. The attention bestowed to ascertain this point in these experiments will, at least, throw some light on the subject; and may induce others, better qualified, to extend the enquiry (here in India), where tanning materials abound.”

Babul-bark was perhaps one of the most extensively used and most highly valued of the crude tanning materials of India. The Babul pods had also tanning quality. Roxburgh was the first person to draw the attention of Europe to the large and valuable supply of these

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165 George Watt, Commercial Product, p.6
pods that might be procured from India. However, this subject did not get much attention until 1884, when pods got high valuation as tanning materials.

**Timber**

The frequent war, from Seven Years War onwards, exposed the deterioration of timbers and its supply. Britain faced the continuous decay of navy timber or large great Oak. In 1771, the parliament took attention to the consideration of this subject and a Committee was formed for the enquiry of the situation. As Parliament ordered:

“...as to induce the House of Commons to nominate a Committee to inquire into the foundation for the alarm, which began at that time to prevail in the country respecting the diminution of Naval Timber.”

In this respect the appointed Commission, dated 6th February, 1792, divided the consumption of Oak timber into three general categories. a) The first comprised the quantity required for the internal purposes of the country, in which timber of all sizes was used, including leather industry and tanning purposes. B) The second was confined chiefly to the timber of middling size, included what was employed in building merchant ships for the whole trade of the kingdom, and C) the great timber that was used in the construction of large ships of war.

Commission illustrated about the navy use, because only large or great size of timber could have been used in construction of war-ship. So the long maturity period of tree was

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166 George Watt, Commercial Product, p.7  
167 From the 16th century, vessels were often built of a size requiring masts taller and thicker than could be made from single tree trunks. The lack of large oak sometimes made the ships so poor that even Nelson was affected. England was not alone in her naval problem, for her chief maritime rivals, France, Spain, and Holland, were in a similar situation. Diplomats often made efforts to secure a supply of timber from abroad so England’s Baltic policy was chiefly a matter of keeping the sea open at all costs, in order to ensure a supply of naval materials. It also became a practice of the English to cut off the enemy’s supply of timber while maintaining their own.  
169 Under the third category that was the consumption of large Oak timber used in the construction of large ships of war, the Commissioners of Land Revenue state, that in 1788 the tonnage of the navy amounted to about 413,000 tons, and that the annual consumption of timber was than estimated at somewhat more than 50,000 loads. Ibid., pp. 6-8.
considered for the cause of the immediate need for the alternative resources. Henry Dundas was the first person who related the scarcity of native navy timber and the search of alternative resources from the India. As the political master of the Indian Administration, Dundas was aware of the different report on the shipbuilding resources of the region over the period of 20 years. Consecutively, the Earl St Vincent, first Lord of the Admiralty from 1801, expressed the desire for the Company ‘to build one ship of the line and one frigate at Bombay every year.’

In India, East India Company started for the search of alternatives. The establishment of Calcutta Botanical Garden had initial aim to transplant teak tree from Pegu (Bogo region, Myanmar), and from Godavari region. Lord Cornwallis and Colonel Kyd established this place as the hub of teak trees. Since the teak took 60 to 100 years to reach the maturity, so the consecutive or uninterrupted supply needed frequent plantation and limited use. But continuous wars and exploitation of timbers compelled empire to think in terms of quantity. Company could have compromised the quality or durability of timber but not quantity. So the Burmese Teak was the best option for unremitting war, as it was available in great quantities. The objections raised against the teak was because of its heaviness and unfit for fighting


171 The great advantages of teak were that it was easy to work, strong, oily and without knots. It required no seasoning and had very little tendency to rot. Ships built of it, and especially those of Malabar teak, would last almost indefinitely. An oak-built ship used to last on an average some ten or twelve years. Teak-built ships frequently lasted eighty years and more. Malabar teak was the best for shipbuilding, and it was in this wood that the Surat ships were built. Teak from Java or Coromandel was next in quality but could not be had in sufficient quantity.

172 There were two types of school in ship building in India in the eighteenth century. There were Bombay and Pegu school. The Bombay tradition of shipbuilding was imported from Surat in the year 1735. “Parallel with the Bombay school of shipbuilding, there grew up another building tradition on the other side of India. This had its roots in Pegu, the sources of its timber supply. Ships had always been built there from the earliest times, and here also there must have been some Chinese influence. Pegu teak, if less strong and durable, is lighter and more buoyant than that of Malabar. At Calcutta there grew up, after the middle of the eighteenth century, a shipbuilding industry dependent on Rangoon for skill and timber, not free from the influence of Bombay but producing vessels of a type greatly modified to suit local conditions and needs. The Calcutta yards grew up independently of government and became established as early as 1760, in all probability; later, but not much later, than the establishment of the industry at Bombay. An improvement introduced at Calcutta was the use of certain other kinds of wood for planking, leaving only the ribs, keel and decks to be made of teak.”
ships as it was too liable to splinter after getting struck by shot. This latter objection was made in a letter to the *Naval Chronicle* in 1813. However, during practice it was found that a teak-built ship’s side was almost impervious to cannon shot.

Roxburgh wrote in his *Plants of the Coast of Coromandel* about the Kyd’s order of *Tectona Grandis* (Teke of Telingas)- “After long experienced I can say it is by far the most useful timber in Asia.”

It was very suitable for ship building, because of being light and strong and durable in or out of water. Roxburgh sent teak plants from Rajahmundry to the Collectors of Medinapore, Bhagalpore, and Gaya.

Since his stay at Samalkot, Roxburgh collected different specimens of timber as per its suitability for shipbuilding. Roxburgh spread the idea of teak plantation to the St. Helena also. As Dr. Beatson wrote:

“Neither the teak nor sissoo seed, nor any other of the many timber trees, for I am indebted to Dr. Roxburgh’s Kindness and attention have succeeded at plantation-house; notwithstanding they were sown and treated according to his directions. However, the trees I have enumerated would be sufficient for every purpose; and if the planting system he followed up, St. Helena, in the course of even twenty years, would yield a considerable supply of useful timber, and abound with fuel.”

In this way, by the effort of Kyd and Roxburgh, Calcutta Botanical Garden consisted eighteen species of Indian Teak. As Carey described:

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174 Pegu was producing largest quantity of teak but it was not better than Indian teak in terms of durability. For naval purpose both had their own limitation. Malabar teak was found to be too heavy for the upper works of ships, and altogether unsuitable for making spars. Burman teak was sometimes used for masts, but the Malabar ships usually had masts and sparts made from a wood called ‘Poon’ or ‘Pohoon’, which was obtained from Mangalore and elsewhere on the western side of India.


“It is a most gratifying circumstance that our present Catalogue of Indian plants contain eight hundred and fifty-eight species of trees, some of which produce the best kinds of Timber in the world. The Teak (Tectona Grandis) the Shala (Shorea robusta) and the Sisoo (Dalbergia Sissoo) have long been well known, and deservedly esteemed... The Sit-shala is universally employed to make furniture, and there are but few kinds of woods better adapted for that purpose... The present catalogue furnish us with no fewer than eighteen species of Indian oak, and some of which appear to be nearly or quite equal to English oak.”

Figure: 3.8 Malabar Teak Tree *Tectona Grandis*

II. A Table of the Growth of Trees in the Botanic Garden at Calcutta. By Dr. Wm. Roxburgh.*

The average circumference of several of each sort of trees mentioned in the list, in inches and quarters, was taken 4½ feet above the ground, at the end of October, when the year’s growth may be reckoned over. The difference between the numbers in the adjoining columns gives one year’s increase in the circumference of each sort.

<table>
<thead>
<tr>
<th>Names of the Trees</th>
<th>Synonyms</th>
<th>Years Age of the Trees measured in 1803 and 1804.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tectona grandis</td>
<td>Peak, E. Siquon, H.</td>
<td>7 10½ 16½ 21½ 37 38 51 53½ 70 75</td>
</tr>
<tr>
<td>Swietenia Mahogany</td>
<td>Mahogany, E.</td>
<td>25 30 32½ 32½ 42 44½</td>
</tr>
<tr>
<td>Swietenia chickasass</td>
<td>Chickass, H.</td>
<td>25 30</td>
</tr>
<tr>
<td>Swietenia febrifuga</td>
<td>Soymida, T. Rubeca, H.</td>
<td>21½ 24½</td>
</tr>
<tr>
<td>Terminalia alata-tenientosa</td>
<td>Asean</td>
<td></td>
</tr>
<tr>
<td>Terminalia biata</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminalia catappa</td>
<td>Buddan</td>
<td></td>
</tr>
<tr>
<td>Terminalia gucoera</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminalia beferica</td>
<td>Beheyrah, H.</td>
<td>20 23½</td>
</tr>
<tr>
<td>Dalbergia sisso</td>
<td>Sisso, H.</td>
<td>20 23½</td>
</tr>
<tr>
<td>Dalbergia oontenensis</td>
<td></td>
<td>5 13½ 14½ 17½</td>
</tr>
<tr>
<td>Dalbergia emarginata</td>
<td></td>
<td>20 23½</td>
</tr>
<tr>
<td>Pterocarpus marsupium</td>
<td>Yangashaw, T.</td>
<td></td>
</tr>
<tr>
<td>Pterocarpus Dalbergioides</td>
<td>Andaman, red-wood</td>
<td></td>
</tr>
<tr>
<td>Cedrea tonna</td>
<td>Toom, or Tooni, H.</td>
<td></td>
</tr>
<tr>
<td>Minosa sereesa</td>
<td>Serees, H.</td>
<td>22 22½</td>
</tr>
<tr>
<td>Minosa Xylacapa</td>
<td>Conda-tanghreco, T.</td>
<td></td>
</tr>
<tr>
<td>Minosa elata</td>
<td></td>
<td>22 22½</td>
</tr>
<tr>
<td>Minosa stipulacea</td>
<td>Andooki</td>
<td></td>
</tr>
<tr>
<td>Minosa lucida</td>
<td></td>
<td>22 22½</td>
</tr>
<tr>
<td>Pterospermum Paniculatum</td>
<td>Mows-jal, H.</td>
<td>42 54½ 64½ 21½ 24½</td>
</tr>
</tbody>
</table>