

BEGINNING OF MODERN BOTANY IN INDIA BY DUTCH IN 16TH-18TH CENTURY (BASIC FEATURES AND CHARACTERISTICS)

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Modern Botany in India is indebted to the pioneering works of Dutch Naturalists: l'Ecluse, Rheede, Sijen, Hermann, J. Commelijn, C. Commelijn, J. Burman, N. L. Burman f. and others. Herbalist l'Ecluse first provided (1567) Latin diagnosis of Indian plants from the book of a Portuguese writer, Garcia da Orta. Rheede published (1676-1693) trivial names, Latin diagnosis and illustrations of 794 Indian plants. The Dutch also introduced the art of "*hortus siccus*" and botanical gardening in India. Professor Sijen adopted "*Bauhinianis de nominationibus*" for the annotation of Indian plants in the first volume of "*Hortus Malabaricus*". Sijen also introduced Hermann to the Governor of Dutch East India Company.

During Cape period (1682-1772) Hermann at Leiden garden, Jan Commelijn and Casper Commelijn at Amsterdam garden stimulated a strong interest for Indian plants in the sea merchants which resulted in vigorous and enthusiastic plant collection in Dutch East Indies. They published a series of books on Indian plants and prepared new glass houses and conservatories for sophisticated studies of Indian plants. Wealthy Dutch naturalists avoided Indian Peninsula for the fear of diseases. Linnaeus completed his botanical training in Holland. With access to the excellent botanical gardens, libraries, herbaria and scientists he provided binomial names of Indian plants. The Burmans first introduced (1768-69) binomial nomenclature and sexual system in the study of Indian plants. N. L. Burman first drew up a systematic account of algae, fungi, bryophytes, pteridophytes and phanerogams in his epoch-making book, "*Flora Indica*".

By this time other European collectors, e.g. König, Thunberg, Lindley, Klein, Russel, John, Roxburgh, Rottler, Sonnerat, Retzius, Heyne and others were rivals to those of Holland. Rottler (1773), Retzius (1779-1791) and Roxburgh (1795-1832) published their works. Herbaria of other collectors were annotated and published by the scientists at home: Roth, Schrader, Willdenow, Vahl, Smith, Lamarck and Poirot. From the end of the 18th century, English naturalists surpassed the Dutch workers with the establishment of the Asiatic Society (1784), the Indian Botanic Garden (1787) and began to provide systematic accounts of Indian plants (1783-1947). Concurrently they wrote two "*Flora Indica*" (1814-1832; 1855 or 1872-97) in the English language.

INTRODUCTION

India occupied a distinct place in the field of history of science during the Ancient and the Mediaeval period. While Europe was passing through the Dark Age,

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India had her glorious Classical Age showing remarkable achievements in Mathematics, Astronomy, Chemistry, Metallurgy, Botany, Medicine and other subjects right up to the twelfth century. However, after this period, Indian creative efforts started showing a sign of decay, partly due to traditionalism and partly political disturbances. In this period of decadence, the country needed a re-vitalizing and re-awakening force within herself. After waiting for few centuries she had it, but from outside. It was Western Science introduced by the Europeans who came first as traders and later governed the country. Europe saw the dawn of modern science in the sixteenth and seventeenth centuries. Since then its triumph marched on penetrating beyond the geographical limits of the West. India, famous for her power of assimilation, succeeded in bodily grafting the contents of the Western Science as actively pursued in contemporary Europe. But the process of this grafting of the Western Science was started by the Western scholars themselves and many of them came to India to serve under different trading companies in various capacities as civil and military administrators, medical men and royal engineers. These people had the explorers' temperament of mind and became immediately interested in men and nature, geography and natural resources of the little-known subcontinent. The waves of the scientific revolution in Europe reached the shores in India also where investigations started resulting in better knowledge of the climate, flora, fauna, geography, etc. In this study, the western method and techniques were employed, and before long the virgin soil yielded a rich crop. This study started with the individual efforts of a few scholarly people which laid down the foundations of our field sciences.

Modern Botany in India is derived from the works of the Dutch naturalists, notably Carolus Clusius (Charles de l'Escluse), Drakenstein Hendrik Van tot Rheede, Paul Hermann, the Commelijns and the Burmans. It is a remarkable fact that in Indian civilization (isolated from European culture), the science of Botany flourished as evidenced in *Vrkṣāyurveda* of Parāśara, probably compiled before the beginning of Christian era (Majumdar 1946). Since then, India had little to do with the formation of modern systematic botany. Modern period of Indian history started with the successful voyage of Vasco da Gama in May, 1498. "It is [also] of interest to note that the years 1542-43, when the first modern botanic garden was established, can be conveniently even if arbitrarily taken as marking the end of the Middle Ages in science since they also saw the publication of three important works manifesting in illustrations or text a direct approach to the natural world, i.e. Fuchs, *De Historia Stirpium* (1542),... Vesalius, *De Humani Corporis Fabrica* (1543) and Copernicus, *De Revolutionibus Orbium* (1543)" (Stearn, p. 227, 1971). However modern botanical study of Indian plants, of living plant in the Dutch or Indian colonial gardens and the wild in the Dutch colony, and of dead plants in the laboratory had been initiated by the Dutch in the 16th and continued until 18th century. Almost all requirements of modern study of the Indian plants, i.e. botanic gardens, herbarium, illustrations, Latin diagnosis, polynomial to binomial nomenclature, application of a moderate system of classification in the floristic account had been accomplished by the Dutch in this

period (16th to 18th century). For our present purpose, then, we describe as the modern botanical study of Indian plants that which begins four hundred years ago, which is marked off by an evident and intelligible line from the time immediately preceding, and displays in its course specific and distinctive characteristics of its own.

THE PORTUGUESE

The End of an Era. The Portuguese are the first European to recognise the inadequacies of the Indian botanical writings of the ancients like Theophrastus (b. 370-d. c. 285 B.C.), Pliny (b. 23—d. 79), Dioscorides (in and around 20-80 A.D.) and others. Before their defeat of Armada in 1588, of Hooghly in 1632 and cession of important harbour of Bombay in 1661 they (the Portuguese) were the leading European power in India. They pursued solely the interests of dynastic power and fiscal needs. They sent nobles and Government officials to provide administrative expertise in their territorial empire. The colonial administrator and botanist, Garcia de Orta (b. c. 1490-d. 1570) first wrote a book in Portuguese treating exclusively the plants from India. He published *Coloquios dos simples e drogas he cousas medicinais do India* from Goa on the 10th April 1563. Subsequently Acosta Christobal (Christovao da Costa) (b. 1512-d. 1580), Spanish physician and botanist, documented Garcia's work along with the works of Theophrastus, Pliny, Dioscorides and others in his book entitled as *Tractado de las drogas, Y medicinas de las Indias orientalis*. Spanish original of Acosta was published from Burgos in 1578. These two books were also provided with woodcut illustrations. These are recognised as Portuguese Botanical classics. Recently (1963, 1964) Lisbon Academy of Science reprinted these books with introductions and notes to commemorate Garcia's contribution. Garcia and Acosta were chiefly motivated by practical consideration, i.e. medical uses of the plants. These books represented a type that came to be known as the herbal. The drawback of such works was that these were written in their own vernaculars. Hence these works remained largely unread, unknown and ineffective. Actually in this period scholars interested in plants were few in every nation and publication in their vernacular languages imposed serious limitations. To indicate the rarity of Garcia's book Stafleu (1967) stated that there were only ten copies of it in Europe (nine in Portugal and one in Geneve). These limitations of their works were utterly and entirely the fruit of scholasticism. From these considerations we must look upon them as the end of an era (The middle age).

THE DUTCH

The Beginning of a New Epoch in Indian Botany. A monumental breakthrough for Indian Botany that occurred at the time of European Renaissance was heralded by the publication of Clusius, viz. *Aromatum, et Simplicium aliquot medicamentorum apud indos nascentium historia* (1567, 2nd ed. 1574). It is the first book in classical Latin treating exclusively plants from India. The main basis of this book was Garcia's *Coloquios. . . . da India*. In Latin it became a direct contribution to a common European

pool of learning and stimulated the development of Indian Botany in a co-operative effort. The impact of this work was far reaching in the history of Indian Botany.

Carolus Clusius (b. 1526—d.1609) father of the bulb industry, an inquisitive natural scientist, botanical traveller, scientific horticulturist and plant taxonomist was very interested in the introduced plants. His study and travels carried him through Vienna, Frankfurt, Hungary, Italy, Portugal, Spain and England; all the while he was engaged in obtaining and discovering new plants. By birth he was a Flemish Austrian. He arrived at Antwerp, Netherland (now in Belgium) in 1554. Clusius was a man of wide friendships and had an extensive botanical correspondence. He saw *Coloquis* in Lisbon or Coimbra probably during his stay in the fall of 1564. He obtained a copy of it with his pupils L'Obel and Jean Bauhin and took it back to Flanders where he started on a Latin translation while at Burges. He thoroughly revised the description, annotated 69 species and added new drawings based on materials from Antwerp drugstores. At that time no herbarium materials had been made of Indian plants. He added commentaries of his own. This book *Aromatum...historia* appeared in Frankfurt market. He also translated and annotated Acosta's *Tractado Indias Orientalis*. In the revised book he adopted one or two original drawings of Acosta and added much of his own. He also published: *Rariorum aliquot Stripium per Hispanias observatarum historia* in 1576 from Antwerp; *Aliquot notae in Garciae aromatum historiam* in 1582 from Antwerp; and *Exoticorum libri* in 1593 (2nd ed. 1605) from Leiden. To write *Aliquot* he received some materials from his English friend, Captain Sir Francis Drake. In *Exoticorum* he revised the works of Garcia, Monardes, Acosta and Belon. Some of his herbarium materials were inherited by his pupil, Jean Bauhin and these are at present preserved in Basel, Switzerland. He became the director of the Psychic gardens of Vienna, Leiden and finally a professor at the University of Leiden. He greatly influenced the development of Indian Botany and the developments of botanic garden in Europe. To appreciate and commemorate his services he may rightly be designated as the Dutch father of Indian Botany.

Up to 1600 Dutch did not venture in Indian trades and there was a close friendship between the Portuguese and the Dutch. The Clusius version of 1567 is also reproduced by Lisbon Academy of Science in 1964 with Portuguese and Dutch legends. According to Stafleu (1967) it is an interesting document recalling a time of close contacts between the two nations and common interest in the countries of the east.

Dutch expansion

In 1601 the Dutch decided to explore the commercial potentialities of India and sent two merchants, de Wolff and Lafer. They remained in Surat on behalf of the Middelburg Company, one of the *Voor-Compagnieen*. They proceeded towards Malabar in April, 1603 and were intercepted by the Portuguese on their way. They were taken to Goa and hanged. In 1602, the *Voor-Compagnieen* ceased to exist with the formation of the "*Vereenigde Dost—Indische Compagnie*" or the Dutch East India Company (V.O.C.). from the seventeenth to eighteenth century (1772) the

Dutch were the first maritime power in the world. This period is recognised as the golden period of Holland. Belgium was under their command up to the early period of nineteenth century (1830).

Under the command of Admiral Stephen van der Hagen in 1603 and Cornelis Matelief in 1605 the V.O.C. sent their fleet in East Indies. Through this voyage David van Deynsen and his assistant J. Huissen arrived in Surat and met a violent death due to the direct hostility of the Portuguese and the Mughals. Within 1614 V.O.C. had become firmly established on the Coromandel coast and in the spice islands. In 1617 they obtained a *forman* to continue their trade in Surat. This *forman* was issued by Prince Khurram. Dutch East India Company (V.O.C.) built their capital in Batavia (Java) in 1619. In this year a treaty was signed between the English East India Company and the V.O.C. and it became the pivot of Anglo-Dutch relations. As a consequence they organised a Fleet of Defence which was governed by the joint membership council of Defence. During the early months of 1625 there was a fierce confrontation between this Fleet of Defence and the Portuguese. As a consequence many of the Portuguese members of the nobility, were killed depriving the *Estado da India* of essential leadership and military expertise (Radwan, 1978). In this year (1625) Zamorin (King) of Calicut asked Van Speult, a Commander of the Dutch fleet for a significant commercial activities in Malabar. Poonen (1948) emphasised that Zamorin offered a guaranteed annual supply of pepper at a very low price. Thus they built a fortified factory at Malabar and became very prosperous in Malabar or in Western coast of India.

FIRST BOTANIC GARDEN, 'HORTUS CICCUS' AND FLORISTIC STUDY

As the age of herbalists were on we have seen botany rise from a position of dependence upon medicine to that of an independent science. In the ancient 'physic gardens' plants were arranged according to their uses to man; but subsequently there was a growing effort to classify them according to their own natural relationships. At the same time there gradually arose a desire for a more precise system of naming plants. Dutch administrators established modern botanic gardens in their motherland, i.e. Lieden (1587) and in their Colony, Malabar (ca. 1664). As this latter garden was associated with the botanical research of Rheede, it is proper to call it the first modern botanic garden in India. Professor Clusius cultivated introduced plants in Leiden and this practice had been followed by his successor. Prof. Sijen continued it till his death in 1678. At that time H. A. Van Rheede tot Drakenstein was the Dutch Governor of Malabar. He was an amateur botanist. Mr. Rheede began the modern study of Malabar plants and illustrated native plants collected either in his gardens or in the wild. Prof. Sijen annotated the first volume (1676) of Rheede's illustrations and provided commentary and good latin diagnosis of the studied plants. In this book, *Hortus Indicus Malabaricus* Rheede clearly stated that '*hortus siccus*' (herbarium) had been prepared at that time. But for the want of proper citation, no excicate of Rheede had been traced in any herbarium. Prof. Sijen adopted "*Bauhianianis de nominationibus*" for annotation.

Here Prof. Sijen adopted a polynomial system of nomenclature. Prof. Sijen also introduced Paul Hermann (b.1646—d.1695), a German immigrant to the V.O.C. Hermann was appointed an ordinary and first physician. He collected plants from India (specimens preserved at Geneva and Leiden), Ceylon (British Museum, London, Geneva and Leiden) and Cape of Good Hope during his sojourn in 1672 to 1679. In 1680 he became a Professor of Botany in Leiden. Later John Hartog from Leiden Garden followed the footsteps of his predecessor but "Hartog seems not to have long survived" (Boulger p. 370, 1899).

Paul Hermann collected many sets of plants and distributed his collections to different prominent botanists but all types of plants were not represented in a set and each set was not the exact duplicate of the other (Bhattacharyya, 1976). These specimens of the 17th century became holotypes of a large number of Indian Plants. William Sherard, the Burmans, Linnaeus and Günther made use of his herbarium in the 18th century. Hermann arranged the Leiden garden according to the Mechanical system of Morison with modifications. Contemporary Amsterdam burgher, Jan Commelijn (b.1629—d.1692) was a merchant, druggist and botanist. He had been elected as an annotator of Rheede's *Compendium*. Under his editorship the rest of the eleven folio volumes had appeared till the late years of the 17th century (1693), Jan prepared many herbarium specimens which are amassed in the Sloane Herbarium, British Museum, London. He also published *Horti medici amstelodamensis rariorum tam orientalis; pars prima* in 1697 with 220 pages of text and 110 plates. Its second part had been published in 1701 with the collaboration of his nephew, Professor Casper Commelijn (b. 1667/1668-d. 1731). In second part there are 224 pages of text and 113 plates. Jan also published *Catalogus plantarum horti medici Amsteladaemensis* in 1702 from Amsterdam. Its third edition was edited by Casper Commelijn in 1724. Casper Commelijn also published *Flora malabarica, Sive Horti Malabarici Catalogus* in 1696 (Figs 1 and 2).

Modern botanic garden of Amsterdam had been established in 1682. The role of this garden in the contributions of the Commelijn has been emphasized by Stearn (1961, 1971) Hermann at Leiden garden and the Commelijns at Amsterdam garden stimulated a strong interest for plants of Netherland—Indies of the Dutch Sea merchants which resulted in vigorous and enthusiastic plant collection. They prepared new glass houses and conservatories for sophisticated studies of the tropical plants. In this period (1701-1737) "botanists had great difficulty in allocating to genera and in naming the new plants coming, to Amsterdam from the Indies. Capable artists portrayed them, then had to leave them unnamed" (Stearn p. 228, 1971). Sometimes they simply numbered the introduced plants or labelled them with polynomial names in their botanic gardens. No herbarium specimen of Casper Commelijn is known with certainty but some of the materials of Oxford University Herbarium are supposed to be of Commelijn (Clokje, 1964).

Dr. Engelbert Kaempfer (b.1651—d.1716) was another Dutch explorer in India. He was German by birth. Though he was a physician, he had been appointed as Dutch

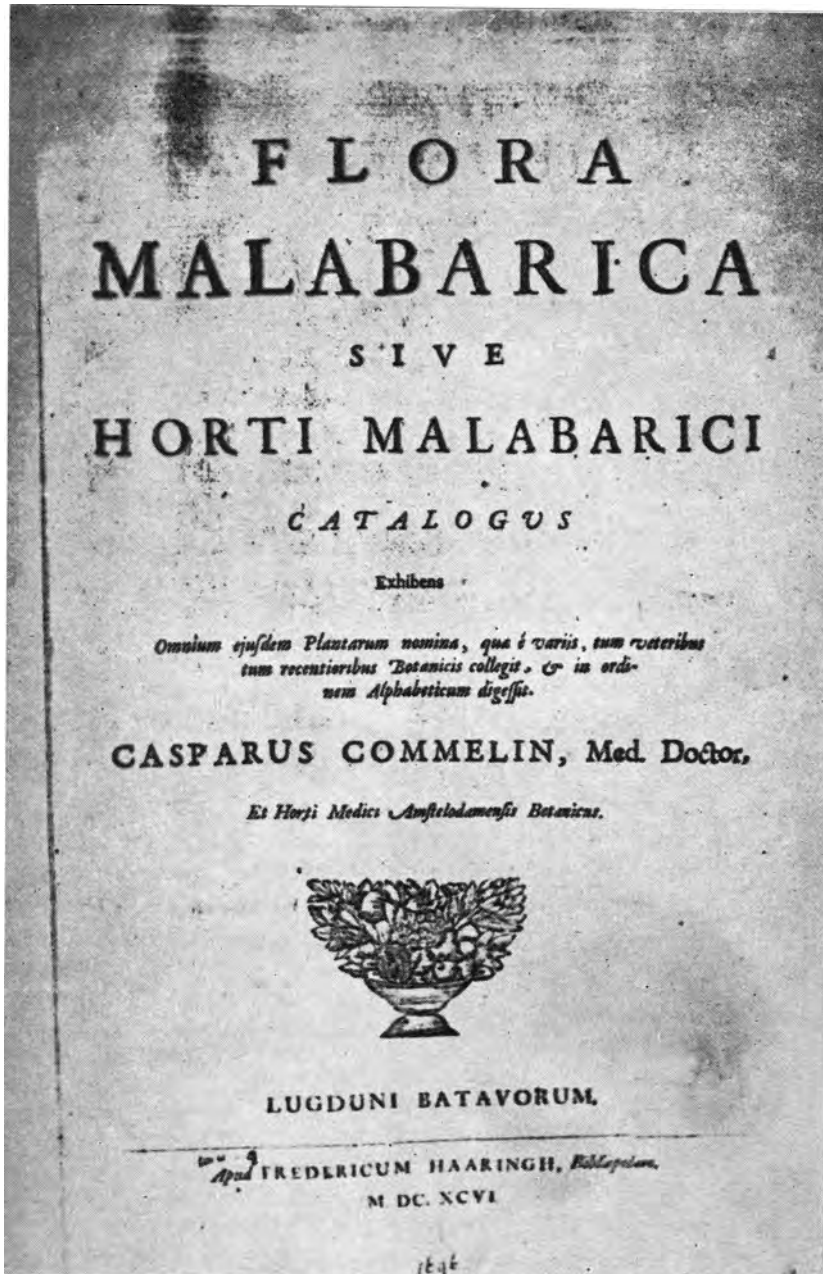


FIG. 1. Title page from Commelin's *Flora Malabarica*.



FIG. 2. First text page from Commelijn's *Flora Malabarica* showing polynomial phrase name of plants which are classified in alphabetical order.

Secretary to Swedish, Russian or Persian embassy for nine years (1685-1693). He collected plants in India along the banks of the Ganges and in Java, Japan and other adjoining areas. His collections are preserved at the Sloane Herbarium, London. He published five volumes of a book entitled as *Amonitatum exoticarum Politics physico-medicarum* in 1712. The sixth volume carrying 600 figures of Indian Plants has unfortunately been lost (Herbert, 1832). Some of the selected illustrations from the Kaempfer had been published by Sir Joseph Bank in 1791, London. Commelijn's successor Johannes Burman (b.1706—d.1779) was a physician and Botanist at Amsterdam. He was a friend and correspondent of Linnaeus and elected as Professor of Botany at the *Hortus Medicus* (Physic garden), Amsterdam from 1728 onward. At that time "Botany had flourished here (Netherlands) as nowhere else in the World". "Even Linnaeus had come to Holland attracted by the vigour of botanical science here and the well-filled botanical gardens" (Smit, p. 6, 1979). Dr. Burman acted as the powerful promoter of Linnaean thought and method. He got hold of the collections of Paul Hermann, Pnyon, Kleinhoff and Laurent Garcin and ultimately sent plants to a French, de Jussieu (b.1748—d.1836), a Swede, Linnaeus (b.1707—d.1778) and a German, J.C.D. Schreber (b.1739—d.1810). Thus Burman's sets of herbarium are placed in Institute de France, Paris; Linnean Society, London and München, East Germany. Garcin Laurent (b.1683—d.1752) was a Dutch Army physician and made three trips to the East Indies, India and Ceylon between 1720 and 1729. Some of the specimens of Garcin are at present preserved in British Museum via British botanist Lambert (b.1761—d.1842). J. Burman's son Nicolus Laurens Burman (b.1734—d.1793) is an important contributor to Indian Botany. Nicolaus' specimens are preserved at Delessert herbarium, Geneve, Switzerland. In that period J. Gronovius (b.1690—d.1762) was a professor at Leiden. In 1735, Linnaeus arrived at Netherland. Staffeu (1967) emphasised that Linnaeus contributed in Burman's *Thesaurus Zeylanicus* (1737). Dr. Gronovius and Dr. Boerhaave (b.1668—d.1738) helped Linnaeus get acquainted with Dutch botany.

At Netherland Linnaeus completed his botanical training. With access to the excellent Dutch botanical gardens, libraries, and herbaria he wrote *Flora Zeylanica* (1737) and later on he provided two-word names for Indian plants in his *Species Plantarum* (1753) and developed a mechanical system of classification.

Thus the 1689 *Planta aquatica aphyllis repens flore Caeruleo difformis* of (Rheede) Commelijn was recorded in Ray's *Historia Plantarum* (1704) as *Aphyllis aquatica volubilis florum caeruleo dipetalo de formis, calcari donato*, in Hermann's *Musaeum Zeylanicum* (1717) and in Burman's *Thesaurus* (1737) as "*Flore Coeruleo, Calcitrapae facie*" and in Linnaeus' *Flora zeylanica* (1747) as *Scapo nudo, squamis vagis alternis subulatis*. Later Linnaeus introduced consistent two-word names (binomials) for species intended in 1753 to be used concurrently with diagnostic phrase-names but by the end of the next thirty years used as total substitutes for these, which then became obsolete designations. Thus the 1747 *Scapo nudo, squamis. .subulatis* is now recognised as *Utricularia caerulea* Linn. In 1769 N. L. Burman adapted Linnaean system of

classification and naming in his *Flora Indica, Cui accedit series zoophytorum indicorum, nec non prodromus florae capensis*. Not only phanerogams but also all known algae, fungi and other cryptogams were recorded in it. He illustrated his account and recorded about one thousand three hundred and five species. Following the same taxonomic procedure Johannes Burman published a book entitled as *Flora Malabarica Sive Index in Omnes tomos "Horti Malabarici" conscripsit* in 1769, Amsterdam.

Linnaeus' methodical concise descriptions of genera and his diagnostic phrase-names for species associated with his binomial specific nomenclature thus immensely simplified the study of plants, made it popular among the botanists and stimulated the botanical investigation of distant countries and the introduction of their plants into European gardens. Similarly by the end of the 18th century many unnamed illustrations of Commelijns and others had obtained binomial names with the help of Solander, Dryander and Robert Brown and these were recorded in a descriptive catalogue of Aiton's *Hortus Kewensis* (1789; 2nd ed., 1810-13). The Linnaean reform of botanical nomenclature is the main reason why botanical and horticultural information published in books before 1753 has become relatively inaccessible. No one library now possesses all the relevant literature for a survey, although in the Calcutta area, the libraries of the Central National Herbarium (Sibpur), the Asiatic Society and the Geological Survey of India, collectively have almost all that is needed.

Linnaeus' disciple, Johann Gerhard Koenig (b.1728—d.1785) explored India in 1767-1785. He was a Baltic German by birth but in 1759 he became a Danish missionary in profession. He developed a strong interest for the modern study of Indian plants along with other Europeans. By this time French Lamarck, German Willdenow, British Roxburgh and Danish Vahl followed Linnaean principles and procedures in their publications related with Indian Botany (Bhattacharyya 1976).

Fall of the Dutch activity

After the age of the Burmans, Netherlands lagged behind intellectually and other Europeans launched worldwide expeditions. Thunberg, Lindley, Klein, Russel, John, Rottler, Roxburgh, Sonneret, Retzius, Heyne became rivals to those of Holland. Rottler Retzius and Roxburgh published their works but others sent their specimens to their scientist at home: Roth, Schrader, Willdenow Smith, Lamarck, Vahl and Poirot. Thus the museums of London, Paris and Copenhagen had been enriched. The Dutch established *Bataviaasch Genootschap van Kunsten en Wetenschappen* (Batavian Society of Arts and Sciences) in 1778 but the activity of this society was very low. On the other hand the British established the Asiatic Society of Bengal in 1784, Sibpur Botanic Garden in 1787 and Saharanpur Botanic Garden in 1820.

Smit (1979) pointed out that the colonial policy of the V.O.C. was one of the causes of this (the Dutch) decline. In that period Dutch trade was at a low ebb; profits decreased. Dutch colonial "Governors had shown themselves less and less inclined to admit naturalists" into their territories. For the mercantile interest

stockholders adopted this secrecy. "Private possession of geographical maps of territories held by the V.O.C. was a criminal offence." Dutch merchants had secured their capital by investing in England and other countries. Above all, wealthy Dutch naturalists were reluctant in the expedition works for the fear of diseases in land and sea. In 1759 the Dutch was defeated by the English in Hooghly and this was the end of the Dutch power in India. Afterwards the Netherlands were greatly impoverished when they launched war again with the English in 1780. Thus at the end of 18th century the Dutch became a nation of rentiers and paupers.

CONCLUSION

Science is one of the manifestations of man's intellectual efforts and very often it has been found to be associated with intellectual revival. The European renaissance of the 16th and 17th centuries brought about the emergence of modern science. In India during the periods of her intellectual ascendancy in the Vedic times, the Buddhist supremacy, or during the Brahmanical revival, science and technical arts were cultivated. But after this period Indian creative efforts started to show a sign of decay. However, modern Botany in India came into being from the works of the Dutch Naturalists of the 16th, 17th and 18th centuries. During the 19th century the English prepared their "*Flora Indica*" in their own language. In conclusion, it may be said, the seeds sown by the Dutch workers in the 16-18th century flourished in the English period, i.e. 19th to the 1st half of 20th century. Again, when the impact of the West in the 16th-19th century catalysed the Indian mind to positive thinking, the modern study of Indian plants was early pursued with the result that by the turn of the century her scientists were found to be contributing significantly to the world fund of botanical knowledge.

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