HISTORY AND REVIEW OF LITERATURE

The history of India right from the vedic period is replete with references to use of fruits. Among the known texts, written references on Indian fruits first appeared in Samhitas and Brahmanas (1000 BC - 600 BC). Rig-Veda Samhita mentions about Pippala, (the fruit of Ficus religiosa). Similar is the case with Yajurveda Samhita referring to Bilwa (Aegle marmelos) and Atharva - Veda Samhita highlighting the use of Kapitthaka (Feronia limonia). In Saitapatha Brahmana there is mention of Amra (Mangifera indica), Pippala (Ficus religiosa) and Amala (Phyllanthus emblica) as in Jaiminiya Upanishad Brahmana and Chandogya Upanishad. Kautilya’s Arthasastra (400 BC) makes mention of a group of sour fruits called ‘Phalamla Varga’, grapes, some vegetable fruits, Nimba, (Azadirachta indica), Kusamra (Schleichera oleosa), Kapittha (wood apple = Feronia limonia) etc.. Sukta (Vinegar) was prepared out of Panasa (Plantain), Amra (Mango) and Amalaka (Amla) and Sura (Wine) from mrudwika (grapes). Kautilya also mentions about ‘Suska Saka’ - dried vegetables and Valliphala - Cucurbitaceous fruits (Hayes, 1945; Sharma, 1979; Singh, 1992).

The great Indian epics Vyasa’s Mahabharata (400 BC) and Valmiki’s Ramayana (200 BC) make reference to several fruits. Jujube (Ziziphus jujuba) as edible fruit from the forest regions is mentioned both in Ramayana
Ayodhyakanda 94.8-9) and Mahabharata (Anusasanaparva 53.19, Salyaparva 37.61-62, Vanaparva 178.8) (Mehra, 1967).

The sculptures from Bharhut and Sanchi (Ashoka's period - BC 273 - BC 232) include Plantain (Musa paradisiaca), Mango (Mangifera indica), Jack fruit (Artocarpus heterophyllus), Grapes (Vitis vinifera), Palmyra palm (Borassus flabellifer) and wild Date Palm (Phoenix sylvestris) (Randhawa, 1986).

Information on Gupta's period (AD 320 - AD 550) comes chiefly from Vatsyayana's Kamasutra. Varahamihira's Brahatsamhita, Amarasimhan's Amarakosha, Manu's Manusmrithi and Vishnu Sharma's Panchatantra tales were also written in this period. Varahamihira who lived at the close of this period (AD 505 - AD 587) mentions in his Brahatsamhita vegetative propagation of jack, plantain, tamarind, wood apple and aonla (Hayes, 1945; Chopra and Singh, 1968; Singh, 1992).

Varahamihira in his Brahatsamhita mentions Kashyapa along with other 3 rishis Parasara, Garga and Vajra. The Krishi-sukti a text on agriculture attributed to Kashyapa holds references on Rice, Areca, Coconut, Masha, Chana, Mudga, Kuluttha, Tila and Pepper. He also advocated cultivating Karanjaka (Pongamia glabra), Sigru (Moringa oleifera), Tinduka (Diospyros peregrina / Diospyros embryopteris), Vata - the Banyan (Ficus sp), Vibhitaka (Terminalia bellerica), Amalaka (Phyllanthus emblica), Likuca (Artocarpus lacucha), Nimba (Azadirachta indica), Ashoka (Saraca asoca), Amra (Mangifera indica), Madhuca (Madhuca indica/Bassia latifolia), Punnaga (Calophyllum inophyllum) etc. Aryabhata, the great Mathematician, Varahamihira, the astronomer, and the poets Dandin, Subandhu, Banabhatta and Kalidasa lived during this period. In his Ritusamhara, Kalidasa describes mango trees in bloom which 'kindle flame of love in the hearts of women'. In his Abhijana
Shakuntalam, there are references on shady avenues, amravana or amra kunja (mango groves), and other fruit plants namely plantain and coconut (Desai, 1957).

The two masterly treatises on medicinal plants Sushrutasamhita and Charakasamhita also mention about some such fruits as aonla, bael, citron, wild dates, wild fig, grapes, hog plum, jack fruit, monkey jack, jamun, ber, karonda, khirni, lemon, lime, mango, mulberry, sweet and sour oranges, phalsa, banana, pomegranate, walnut, almond, pistachionut and wood apple (Chopra and Singh, 1968; Hayes, 1945; Singh, 1992). There is mention of 4 different varieties of jujube viz. Sauvira, Badara, Koal or Kuvala and Karkandhu in Charakasamhita (Mehra, 1967). Charaka described 76 fruits under ‘Phalavarga’ and classified fruits according to rasa (taste) namely madhura, amla, tikta and kasaya whereas Susruta described 84 fruits in his samhita and classified them as sour fruits, kasaya - madhura, madhura suska and tikta - katu (Sharma, 1979).

It is during the period of Harsha Vardhana (AD 606 - AD 647) that the Chinese Budhist pilgrim Hiuen Tsiang (Huan Tsan / Yuan Chwang) came to India (AD 629 - AD 645). He had listed a number of fruit plants in his travelogue called Si-yu-ki which includes Mango, Tamarind, Jujube, Wood apple, Aonla, Fig, Plantain, Coconut, Jack, Pomegranate, Sweet orange, Pears, Plums, Peaches, Apricots and Grapes (Hayes, 1945). He had further pointed out that the fruits of Amla (Ngan - mi - lo ), Madhuca (Mo-tu-kia), Bhadra (Po-ta-lo), Kapittha (Kie - pi - ta), the Mocha (Mau - che), Narikela (Na - li - ki - lo) and Panasa (Panna-so) were esteemed much by the people.

Sarangadhar (AD 1283 - AD 1301) in his treatise Sarangadhar Paddhati introduced a separate craft of nourishing trees called Vrikshayurveda. Varma (1947) refers to an original anonymous Sanskrit manuscript called Vriksha Ropan Vidhi exclusively dealing with fruit plants as one of the pioneer attempts on the
subject in India. However, the first book in the world exclusively dealing with
fruit cultivation is believed to be on litchi written in AD 1056 (Randhawa, 1986).

The Islamic period (AD 1300 - AD 1700) commonly called as the
mediaeval period in the Indian history, in contrast with the earlier Hindu - Buddhist
period of ancient India, was marked with an exponential increase in the number of
gardens and orchards.

The travelogue of Ibn - Battuta who visited India during the Sultanate
period of Muhammad-bin-Tughlak (AD 1325 - AD 1351) gives solitary records on
Ber, Mango, Jack, Jamun, Mahua, Pomegranate, Millets like Kadhru (*Paspalum
scrobiculatum*) and beans like Masha (*Vigna radiata*) and Mung (*Vigna mungo*).
Describing Mulaybar as it was then called Malabar, Ibn - Battuta states that there
was not a foot of land uncultivated. Pepper and ginger were exceedingly
abundant there. Domingo Paes, a Portuguese merchant who visited Vijayanagar in
AD 1520 noted many groves of trees, gardens and profuse - bearing fruit trees
mostly of Mangoes, Jacks, Limes, Oranges, Tamarinds, Grapes *etc.* Another
Portuguese visitor Fernao Nuniz in AD 1535 reported that the markets were over
dominated by fruits such as Grapes, Limes, Oranges, Jack fruits, Mangoes,
Pomegranates *etc.* which were available in cheap prices.

Babur in AD 1526 established the Mughal Empire in India. In his
memoirs, he mentions Mango, Tamarind, Jamun, Plantain, Chironji, Jack, Mahua,
Khirni, Karonda, Ber, Amla, Lime, Burhul, Citron, Date, Coconut, Toddy palm,

As stated by Abu-L-Fazl in Ain-i-Akbari which was written in about AD
1590, Akbar (AD 1556 - AD 1605) looked upon fruits as one of the greatest gifts
of God and paid much attention to them. He also describes Plantain, Mahuwa,
Oranges, Dates, Walnuts, Coconuts, Supari *etc.* Pineapple and Custard apple both
indigenous to Tropical America were the new fruits mentioned in his work (Randhawa, 1986; Hayes, 1945). Jahangir (AD 1605 - AD 1627), a great lover of plants also mentions about Melons, Mangoes, Grapes and Pineapples in his memoirs. Sixteenth Century was also remarkable for plant introduction. Many of the fruit and nut yielding species now grown in India namely Papaya, Sapota, Cashew, Guava, Pine apple, litchi, Mangosteen, Manila tamarind etc. were brought from other countries by foreigners.

Most of the data on the early history of plant introduction is scattered in archaeological records, ethnographies, gazetters and travelogues of several visitors to India and in the classical works like Babarnama or Tuzuk-i-babari (1519), Humayunnama, Tuzuk-i-Jahangiri, Ain-i-Akbari (1950), Garcia da Orta’s Os Coloquios, (1565), Acosta’s Tractado (1578), Rheede’s Hortus Malabaricus (1678 - 1703) etc. (Randhawa, 1986., Mehra, 1966., Maheswari, 1988).

Following the discovery of Cape of Good Hope by Bartolomeo Diaz in AD 1488 and the sea passage to India by Vasco da Gama (AD 1498), many Europeans came to India and introduced a number of New World plants yielding fruits and nuts which include Chillie (Capsicum annuum), maize (Zea mays), Cactus (Cereus grandiflorus), Prickly peas (Opuntia striata var. dillenii), Carambola (Averrhoa carambola), Bilimbi (Averrhoa bilimbi), Durian (Durio zibethinus), Bread fruit (Artocarpus altilis) etc. from such countries as Tropical and South America, China, Mexico, Africa, Malaya, Philippines, Java, Moluccas etc.

The first Europeans to describe Indian plants were (1) Garcia da Orta (AD 1563) in Coloquios dos Simples e Drogas e Cousas medicines da India, (2) Christophoras Acosta (AD 1578) in Aromaticum et medicamentorum in Orientali Indian nascentium liber, (3) Barcelona (AD 1591) in Historia Natural y moral de las Indias Scuilla, (4) Hedrik Adriaan van Rheede tot Drakenstein (AD 1678 -
1703) in *Hortus malabaricus*, and (5) - Dymock, - Warden and Hooper (*AD* 1890) in *Pharmacographia indica*, but most of them dealt only with medicinal plants (Randhawa, 1986; Maheswari, 1988.)

The Italian physician Niccolao Manucci (*AD* 1656), who visited India during the reign of Shajahan made some interesting observations on the fruits of India namely Mangoes, Jack fruit, Pine apple, Coconut *etc.* in his travelogue, *Storia Do Mogor*. He laid special stress on the medicinal qualities of different fruits (Randhawa, 1986).

Botanical works of exemplary value on Indian flora were carried out during the period of British colonization (*AD* 1757 - *AD* 1947). The first journal devoted entirely to Agriculture and horticulture in India was the Journal of the Agri-Horticultural Society of India published by the Royal Agri-Horticultural Society, Calcutta. The first issue of the journal contained a note written by Robert Tyler in 1920 in which he gave a list of fruits grown in his garden which included Lemon, Lime, Orange, Citron, Pomegranate, Pumelo, Fig, Litchi, Guava, Peach, Apple, Vine, Custard apple, Papaya, Plantain, Jamun, Jujube and Mangoes (Hayes, 1945). In his Indian Handbook of Gardening, Speede in 1842 mentions about Peach, Apricot, Almond, Indian almond, Plum, Jujube, Cherry, Jamun, Olive, Native olive, Mango, Hog-plum, Apple, Pear, Quince, Loquat, Malay apple, Litchi, Longan, Wampee, Mangosteen, Custard apple, Bullock’s heart, Sour sop, Avocado, Jack, Guava, Pomegranate, Carambola, Plerardia, Karanda, Paneola Plum, Indian star apple, Papaya, Orange, Citron, Lemon, Lime, Fig, Plantain, Pine apple, Grape, Phalsa, Mulberry, Raspberry, Strawberry, Winter cherry (cape gooseberry), Walnut, Musk melon, Water melon, Coconut, Tar, Wood apple, Bael, Tamarind and Indian sorrel. Pogson in 1872 more or less dealt with the same plants but with much details in his *Indian Gardening* (Hayes, 1945). It was W.G. Mc Ivor, the first superintendent of Government Botanic Gardens, Ootacamund who began large scale cultivation of fruit plants in South
India in 1855. By 1859, he claimed to have 178 species and varieties, most of which were imported from England (Krishnamurthi, 1953).

Regarding the history of plant researches of the late 19th and early 20th centuries in India, James Sykes Gamble (1846 - 1925) and his works namely *A list of trees and shrubs found in the Darjeeling district* (1878), *Manual of Indian Timbers* (1877 - 1879), *Materials for the Flora of the Malay Peninsula and Flora of the Presidency of Madras* (1915 - 1925), *Preliminary list of the trees and shrubs of Ceded districts* (1884 - 1885), *Revised list of trees and shrubs of the Northern circle of the Madras Presidency* (1884 - 85) etc. were remarkable contributions. Cecil Ernest Claude Fischer (1874 - 1950) is another Britisher who made notable contributions to the study of plants in India and Burma. They are *Flora of Northern Ganjam* (1904 - 1905), *Shrubs and trees of the evergreen sholas of North Coimbatore* (1906), *Preliminary notes on the flora of the Anamalais* (1918), *Flora of Anamalai Hills* (1921), *Descriptive list of the forest flora of East Central Madras* (1923) and contribution in part to *The Flora of the Presidency of Madras* (Rajan & Vivekananthan, 1981). However, all these works are mostly on the floristic aspects rather than of economic views.

Presently, horticulture research in India is being carried out by a number of governmental, semi-governmental and private organisations. Indian Council of Agricultural Research (ICAR), Agricultural Universities and Botanic Gardens etc. top the list with this kind of activities. ICAR has regional centres in almost all states in the country. Till date, the horticultural research in Kerala is being carried out by Kerala Agricultural University with its main centre at Vellanikkara (Thrissur) and sub-stations at Kannara (Banana and Pineapple Research Station), Ambalavayal (Central Horticultural Research Station), Panniyur (Pepper Research Station), Pambadumpara (Cardamom Research Station), Vellanikkara (Cashew Research Station), and Nileswaram (Coconut Research Station). The main campus promotes research on Cocoa, Coconut, Pepper, Plantation crops and
Spices whereas the Central Horticultural Research Station (Ambalavayal) concentrates on Citrus and essential oils. The CPCRI (Central Plantation Crops Research Institute), a constituent unit of ICAR conducts and co-ordinate researches on various plantation crops namely Coconut, Areca nut, Cashew, Cocoa, Oil palm and Spices (Black pepper, Cardamom, Ginger, Turmeric, Cinnamon, Nutmeg, Clove and Allspice) in its main campus at Kasargode and 15 other regional stations, research centres and farms. Of these, 5 centres are in Kerala which includes two regional stations at Calicut and Kayamkulam, two research centres at Palode and Peechi and a field station at Irinjalakuda.

In Kerala, the basic research on the plant wealth was by Hedrik Adriaan Van Rheede tot Drakenstein in his 12 Volume work *Hortus malabaricus*. This forms a monumental work on the flora and rich medicinal plant resources of Malabar which in turn was formed out of a burning desire to communicate it to the Europeans by Van Rheede (Manilal *et al.*, 1977; Nicolson *et al.*, 1988; Manilal, 1993).

Although the pioneering efforts of Garcia da Orta, Cristobal Acosta and Jacobus Bontius on the medicinal and other useful plants in the neighbourhood of Goa, Cochin and Botavia form the basis of Asian botany, *Hortus malabaricus* may be considered as the first floristic work of a definite district in Asia (Heniger, 1986). This vast geographic region 'Malabar' included littorals, low lands and mountains from Cape Comorin to Calicut.

Many generic names established by Linnaeus, Adanson, Burman, Lamarck, Jussieu, de Candolle, Kosteletzky *et al.*, were based on Van Rheede’s *Hortus Malabaricus* (Anukul, 1985 and Nicolson *et al.*, 1988). Since 1900, besides floristic works tremendous amount of published information on plant resources of the State was made available by various workers (Manilal, 1981; Ramachandran and Nair, 1981; Prasad and Abraham, 1984; Pushpangadan and
Atal, 1984; Pushpangadan and Atal, 1986; Pushpangadan et al., 1988; Sankaranarayanan, 1988., Sharma et al., 1989; Pushpangadan et al., 1990; Gopalakrishnan and Krishna Prasad, 1992). Most of these works however, dealt with medicinal aspects.

It was King (1869) who for the first time in India published a report on the economic importance of wild food plants. But the useful wild plant research took organized shape with Singh (1945) only after a long gap of 76 years. In 1955, Badhwar highlighted the role of Minor Forest Produce (MFP) for the betterment of the tribal and marginalised people in India. This was followed by a rapid spurt of researches in this line (Krishnamurthi, 1953; Sikka, 1958; Rao & Rangacharlu, 1958; Bhargava, 1959; Vartak, 1959; Gupta & Kanodia, 1961; Kanodia & Gupta, 1961; Jain, 1963; Badhwar & Fernandez, 1964; Jain & De, 1964; Sarin, 1965; Sarin, 1967; Bhandari, 1974; Pal and Banerjee, 1971; Achari, 1973; Chatterjee, 1973; Deb, 1975; Datar & Vartak, 1975; Gaur, 1977; Jain et al., 1977; Arora & Mehra, 1977; Davis, 1977; Atal et al., 1980; Pangtey, 1980; Arora, 1981; Arora & Nayar, 1981; Amalraj, 1982; Maslekar, 1982; Arora et al., 1983; Gaur & Semwal, 1983; Arora & Nayar, 1983; Atal et al., 1984; Doebley, 1984; Acharya, 1985; Girach et al., 1988; Paliwal & Badoni, 1988; Reddy, 1989; Bhagmal & Kochhar, 1991; Kulkarni & Kumbhokar, 1991; Negi & Gaur, 1992; Ansari et al., 1993; Pareek & Sharma, 1993). It should be mentioned that the National Bureau of Plant Genetic Resources (NBPGR) render useful service in building germplasm diversity from indigenous and exotic sources through exchange and explorations (Chandel and Singh, 1984). The establishment of International Board for Plant Genetic Resources (IBPGR) in 1974 which became International Plant Genetic Resource Institute (IPGRI) in 1994 was an organized effort to broaden the world-wide collection of germplasm of major food crops including wild crop relatives and less well-known crops, forage plants and multi-purpose trees. By early 1990s, IBPGR had sponsored some 650 missions in about 130 countries and collected almost 200,000 samples (Zedan, 1995., Guarino et al.,
1995). But in 1993 Chadha and Pareek observed that, inspite of considerable achievements, research thrust was still required for exploitation of unexploited and under-exploited indigenous as well as exotic fruit species and related studies for improvement programme.

The exclusive researches on the fruit plants of South India began with Jacob (1940). In his note on the edible fruits found wild in the Madras Presidency which is considered to be the first exclusive work on the wild fruits of this region, he recorded 68 species. Of these, 64 were indigenous and 4 were exotic but naturalized. He also prepared a descriptive list of bananas grown in the erstwhile Travancore and also reported a species *Musa kattu-vazhana* from the wild. His work on the survey of bananas from Cape Comorin to Gunjain & Canara resulted in publication of a monograph on Madras Bananas in 1952. This contained detailed descriptions, notes on the edible and keeping qualities of the fruit, cropping, growth characteristics and other economic uses of 70 different varieties (Gopalan & Bose, 1981). It is during the same period that Sundararaj (1952) made a survey on the fruits growing in the Madras State. But the object was only to study the performance of the known types of fruits in all the 24 districts including Malabar. This was a larger geographical entity including the present day Tamil Nadu, parts of Andhra Pradesh, Karnataka and Kerala (Naik, 1983). It is with the establishment of Government Botanic Gardens, Ootacamund in 1848 that horticultural work in Madras State commenced in a useful and systematic manner (Krishnamurthi, 1953). But fruit research in the State as a separate entity may be said to have commenced in the year 1941 (Nair, 1956). In fact, the State Kerala formed as a result of the union of the princely States of Travancore and Cochin and the Malabar in 1956, then part of the British - administered Madras Province faced a long gap in the field of fruit research especially of wild plants.

After, Jacob (1940), little attention was given to a survey based research on the economic plants (Abraham et al., 1976) particularly on the wild fruit plants
of Kerala (Aravindakshan et al., 1984). Puri, 1982 and Nair et al., 1987 have studied the techno-economic aspects of the forests of Silent Valley mainly from the point of non-timber products and Aravindakshan et al., (1984) surveyed the forests of Kerala to find out the useful variability in *Phyllanthus emblica*. Apart from this, data on some other useful plants are scattered in various ethnobotanical publications (Manilal, 1981; Ramachandran & Nair, 1981; Prasad & Abraham, 1984; Pushpangadan & Atal, 1984; Pushpangadan & Atal, 1986; Pushpangadan et al., 1988; Sankaranarayanan, 1988; Gopalakrishnan & Prasad, 1992; Nazarudeen et al., 1996). The role of wild plants in the socio-economic life of the tribals of the State was also highlighted by many workers (Pisharoti, 1935; Gnanambal, 1952; Mukherjee, 1953; Mukherjee, 1954; Kunhaman, 1985).

In early days, as a common property meant for the betterment of the rural and tribal communities, the role of Minor Forest Produce was discussed in considerable length (FAO, 1981; Dogra, 1982; Kulkarni, 1982; Rao et al. 1985; Agarwal, 1986; Jodha, 1986; Kulkarni, 1987; Mahendra et al. 1992; Chopra, 1993). But with the introduction of Forest Acts of 1878 and 1927, in India the access of villagers to forests, and their rights to forest products, were severely curtailed (Bandyopadhyay & Siva, 1990). The Minor Forest Produce which had long been influencing the local and tribal economy of Kerala included cardamom, honey, wax, ginger, myrobalan, medicinal plants, dammar, resin, turmeric etc. There are records of these commodities being exported from the Malabar Coast even in Roman times (Brian, 1986).

Often minor forest produce is of major economic significance in the national economy (Maslekar, 1982) and a major share of the Minor Forest Produce (MFP) is contributed by wild fruits. This includes edible fruits, medicinal fruits, spices, condiments, oil seeds and fruits of other economic miscellaneous uses. Out of 121 items included in the MFP, 46 are fruit items in which 16 items find no collections since 1991. However, the number of fruit
items collected from the forests are far more than those few included in the Forest Department's classification as MFP. This is particularly in the case of those having edible qualities. Although, Raju et al. (1995) have highlighted the potentials of fruit crops for processing industries in Kerala, the emphasis is given solely on the cultivated fruits rather than wild ones. Such a neglected reserve is yet to be evaluated for which the analysis of the food value is a pre-requisite. There is no concerted effort and comprehensive published work on the nutritive analysis of the wild fruits in our country. Apart from certain solitary works (Kulkarni et al., 1991), some of the compilations already available. (Singh and Arora, 1978 and Parmar & Kaushal, 1994) are useful but far from being complete and exhaustive.

The operational land holding in Kerala is too less (0.13 hectare) to be productive and self supporting and landlessness is far more common in Kerala than elsewhere in the country. Even the available lands are not sufficient to grow staple and plantation crops. Under these circumstances, as Dr. Rajendra Prasad had once wondered if there is any other natural resource which gives us so much and of which we know so little as the forests (Sagreiya, 1971), it makes a good case for producing readable literature to enlighten the common people about our forest wealth.

Bothmer & Seberg (1995) have rightly stated that the first step in planning any collection programme for wild species will be a background study of their taxonomy and distribution. They have further mentioned that if published data are lacking or inadequate, the collector may decide to carry out an exploratory, fairly coarse-grid survey of the target species. The latter concept is followed throughout the study with additional inputs from laboratory analysis to confirm the desirability of the man’s oldest food in certain species.