On Arecanut & Its Scope

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Areca Catechu Linn., commonly known as arecanut or betelnut is included in Palmae and is well known for its consumption as a masticatory in India and in the Middle and Far East. The use of arecanut and its cultivation constitute a distinct agricultural feature scarcely less important than other economic crops. Watt[64] states that: "In eastern and north Bengal and Assam, its cultivation has assumed still greater dimensions and that regular plantations of 5 to 20 or even 100 acres occur. Its cultivation has proved to be of the greatest value from the commercial and industrial standpoint. The magnitude and the importance of Indian production of betelnuts may be judged not only by the extent of coastal trade but also by the annual consumption of betelnuts in India itself." He further states, "From the published returns of foreign imports and Indian production, it would seem safe to affirm that the annual consumption of betelnuts in India itself cannot be far short of a valuation of Rs. 225/- lakhs or £ 1,500,000." It is thus apparent that the present production and consumption have exceeded many times the 1908 level, and arecanut has provided to be of considerable value from the commercial and utilitarian standpoint, import of betelnuts itself exceeding now more than Rs. 4,00,00,000 annually. In spite of the increasing economic importance of the fruit, attention seems to have been scantily paid for a proper assessment of the plant either in India or in other countries.

ORIGIN AND DISTRIBUTION.

Arecanut is essentially a tropical palm, its distribution being mainly confined to the South-East Asian countries like India, Ceylon, Malaya, Sumatra, Singapore etc., forming as it were the main belt of cultivation in the tropics. Arecanuts have also been reported from Arabia[15], Formosa[69], Japan[25] and Java[13]. Ridley[59] reports its cultivation northwards as far as in Canton, Amoy, Formosa and the Bonin Islands, Westwards as far as in Socotra and Madagascar and East Africa and Eastwards in the Central Pacific and lately in Fiji. Whether the palms are indigenous to these areas remain still undetermined because of restricted occurrence and absence of wild species.

The original source of arecanut cultivation is still controversial in view of the conflicting statements of different authors, but according to de Martius it is probably the Sunda Islands[21]. It is, however, evident that the palms were cultivated in the Indian Subcontinent from very ancient times and is referred to in Sanskrit works under the name 'gouvaka'. There is a reference to it in a Chinese work, 'San-fu-huang', supposed to be written between 140-80 B. C. under the name 'Pin Lang' evidently a distortion of the Malayan equivalent of the fruit "Pinang" Bretschneider's[11] works indicate that the palms shared the province of

Malayan Archpelago and India in the premier century. The habit of the present system of chewing betelnuts is mentioned in a work of the fourth century. The ancient Arabic writers seems to have recognised the importance of arecanuts and called it 'Fibal', referring to the habit of Indians masticating with lime. Garcia da Orta mentions it as being cultivated in Malacca in 1593[60]. According to Beccari [9], it is possible that Philipines was the original home of the arecanut palms and he has also described the evolutionary conditions leading to the formation of cultivated variety.

BIOLOGY OF THE PALM.

According to Hooker [30], there are 4 species of *Areca*, namely, *A. Catechu* Linn., *A. nagensis* Griff., *A. triandra* Roxb. and *A. concinna* Thw. which are distributed in the Indian Subcontinent, of which the edible arecanuts belong exclusively to *A. catechu*. The morphological and floristic characters of the palm from different countries show no variation except in the size of the fruits [7–9, 45, 27, 51, 53, 55, 60] etc.

The fruits exhibit variations in size and on this basis the plants have gained specific or varietal status from some botanists [7–9, 58]. Other features such as taste of the kernels and nature of the rumination of the endosperm have also been used to classify the types. The only feature dominant in the variability of the fruits is their size and based on this Raghavan and Baruah [55] have recently classified the arecanuts of Assam into distinct types. Sands [60] in this connection writes, "As observations on the flowering of the betelnut palm have shown that the flowers are normally cross-pollinated and that in all plantations and gardens there are numerous types, it will be realised that in the absence of breeding experiments, it is an almost hopeless task endeavouring to decide which of the large number of forms are distinct varieties and races or which are merely unstable hybrids."

The cytology of the species remains lurgely uninvestigated. Darlington and Janaki Ammal [20] mention the chromosome number of the genus as 2n–14. An intensive cytological study of the species with special reference to chromosome morphology may yield results of much interest to the botanist but limitations in practical breeding have to be realised because of the nature of the palm.

The formation of the male and female gametophytes, embryo and endosperm follow the usual pattern [57]. The palms in the different regions exhibit varying degrees of sterility in the juvenile stages reducing the yield to as much as 35 per cent. It has been established that failure of pollination and fertilization and factors of habitat such as climatic, edaphic and biotic contribute largely to the sterility in the palms [54, 56].

BIOCHEMISTRY OF THE FRUIT.

The fruit consists of two distinct parts, namely the fibrous husk and the endosperm which is the edible nut. The husk after being removed is well recognised as a byeproduct of little known value, while the nut itself is used widely as a masticatory. There has, however, been no coherant account of the biochemistry of the husk and the nut. In the case of the nut previous investigations concerned chiefly with the extraction of the alkaloids and the tannins and study of their properties. The marked degree of astringency of the endosperm is due to the presence of considerable quantity of water-soluble tannins which are deposited in the marbled streaks of the endosperm. The nature of the tannins, their origin and their decrease with the changes in the maturity of the fruit are factors of considerable interest. The determination of the proportion of the tannins and their allied substances may also be of significance in deciding upon new uses such as tanning leather hide.

The endosperm is also a rich source of alakaloid such as arecoline, arecaidine, guvacine, guvacoline, isoguvacine, choline etc. which contribute to the narcotic and antihelmintic properties of the nut [28]. The isolastion of the alkaloids of arecanut was first attempted by Jahns [34–37] as early as 1888 and later followed by Hes[29], Chemnitius [17] and others [10, 38]. The alkaloid content of the fruits is low, specially of the Assam types (0-15%) arecoline being the major constituent. Kariyone and Fna Ting report for some Fon varieties the alkaloid contents ranging from 0·29-0·67 per cent.

The nut also contains fats*, carbohydrates, minerals like calcium, phosphorus and iron. The different constituents isolated from the endosperm and their proportions are given in Table I.

TABLE I.

Constituents.	Proportion	Reference
1. Tannins	11·4-26%	Grasser [25]; Baruah *et al* [6]
Catechol	3 gms./800 gms.	Yamamoto and Muraoka [68]
Callic acid	—	Wehmer [66]
Gallotannic acid	18%	Ishikama [33]
2. Alkaloids	0·15-0 67%	Baruah *et al* [6]; Kariyone and Fwa Tung
Arecoline	0·1-0·4%	Henry [28]; Chemnitius [17]
Arecaine	Trace	Baruah *et al* [6]
Arecaidine Guvacine	small quantity	Henry [28]; Baruah [6]
Isoguvacine	Trace	Henry [28]
Choline	Small quantity	Baruah *et al* [6]
3. Fats	4·4-15%	Baruah *et al* [6]; Wealth of India [65]
Sterol (Phytosterol)	Trace	Baruah *et al* [6]; Kuwada and Yoshiki [40]; Market *et al* [42]
4. Proteins	4·9%	Wealth of India [65]
5. Carbohydrates	47·2%	"
6. Minerals	1·0%	"
Calcium	0·05%	"
Phosphorus	0·13%	"
Iron	1·5 mgm /100 mgm.	"

Recently Pathak and Mathur [50] have determined the glyceride and fatty acid component of arecanut fat

The husk consists of numerous short staple fibres embedded in a matrix of parenchymatous ground tissue The chief constituents of the husk are pectins, hemicellulose, cellulose and lignin (Table II).

TABLE II.

Constituents	Percentage	Reference
Pectin	1·5-3 6%	Baruah *et al* [5]
Protopectin	1·5-2·1%	"
Hemicellulose	9·0-16·0%	"
Cellulose	35·0-64 8%	Baruah *et al* [5]; Bull. Imp. In; London [13]; Narayanamurthi *et*;
Lignin	13-27·04%	Baruah *et al* [5]; Narayanamurthi *et al* [48]
Furfuraldehyde	18·75%	Narayanamurthi *et al* [48]
Ash	4·44%	"

PATHOLOGY OF THE ARECANUT PALM AND THE FRUIT.

The palms in the different areas are often subject to attack by certain fungi and insects thereby causing losses to the extent of as much 25 per cent. Many of the fungal pathogens attack the palms during varying stages of their growth and only in a few cases, hitherto recorded, the fruits are attacked. The 'Koleroga' disease of arecanuts caused by *Phytophthora arecae* is most well known[19, 62]. Other diseases such as 'stem breaking disease', 'band disease' and 'bud rot' are also known to cause damage in certain areas but the Physiology of the disease remains largely uninvestigated[46]. In the case of insect pests, the diseases recorded

are due to rhinoceros beetle, white ants and squirrels. The problem of the factors influencing resistence or susceptibility of the palm and the fruit to disease requires further investigations.

SCOPE OF ARECANUT.

The arecanut has not been exploited to the extent as has been done in the case of coconut or other fruit trees, because of the inadequate knowledge in regard to its improvement in cultivation, processing of the husk and chemistry of the nut. It is well known that the fruit is a stimulant masticatory containing a large number of alkaloids and in a country like ours where the bulk of the population looks in for some cheap stimulant, the arecanut deserves special attention.

The custom of using arecanuts as a masticatory and on religious occasions has been dealt by various authors [44, 46, 49]. Ridley[59] and Watt[63] have listed the uses of the various parts of the palm like stem, root, leaves etc. for medicinal purposes among the rural population of Malaya. The nut has enjoyed a long reputation in India and China as an antihelmintic and vermifuge in human beings and animals and was for some time included in the British Pharmocopoeia. These properties of the nut are stated to be due to the presence of the principal alkaloid arecoline and the tannins. In China betelnuts have been used extensively as a remedy for tape worms in human beings and for human *Fasciolopsiasis buski*[22, 23, 32, 67] but later experiments have not been able to confirm this property of the nuts[16]. Ridley[59] also states that the nuts are used as a vermifuge and mild extracts of the endosperm in water or acids act as a larvicide[6].

Attempts have been made in recent years to employ the tannins of arecanut in the leather industry. It is a matter of interest that many studies of arecanuts in the past have been closely associated with the tannin content of the fruit to enable it to be used as a suitable vegetable tanning material or drug[2, 25, 26, 39, 52] etc In India Hooper[31] and Badhwar, Dey and Edwards[1] have listed them as one of the fruits showing futur[e] promise in the leather industry. Baens[6] has also indicated the successful use of the tannins of betelnut in tanning leather hide. Attempts have also been made to see whether 'tanning cutch' could be prepared out of arecanuts[14]. Baruah *et al*[6] have indicated the possibility of preparing writing inks from the endosperm of the fruits falling prematurely and the prepared inks do tend to compare favourably with standard inks in their keeping colour and other properties.

Of the alkaloids only arecoline, exhibits markedly toxic properties. It acts on the normal and peripheral nervous systems producing paralysis which may be preceded by convulsions. Its hydrobromide is recognised by some continental Pharmocopoias and is given hypodermically as a cathartic for horses. It is employed as a taenicide in dogs in oral doses[24]. Clinical and pharmaceutical tests have shown that it can be successfully substituted for pilocarpine.HC[1] in opthalmic treatments.[38].

The husk of arecanut is recognised as bye-product and in India the husk so available amounts to 5,000 tons per annum. It is apparent that before any processes of the utilization of the husk are possible there should be enough data on the chemistry of the husk and the products evolved, as this approach, more than any other largely determines the transformations to which the husk can be subjected. There have however, been accounts utilising the husk for the preparation of card board, insulating wool etc [13, 48]. The chief difficulty in utilising the husk lies in the short staple length of the fibres and the slow rate of decomposition of the husk itself to separate the fibres. Bruah *et al*[5] have evolved a new process for softening the fibres in a quicker time by the action of bacterial pectinases; the processing of the husk into insulating wool and felt in admixture with jute root cuttings and caddies, has also been attempted.

Apart from these, many indigenous uses have also been made form the husk from time to time in many parts of India and Malaya. Brown [12] mentions it as being used for tooth brushes and the softened husk makes an excellant cushion material. The production of activated carbon from the husk has also been attempted [18].

Arecanuts, on the other hand, have certain adverse effects also. Arecanuts are supposed to prevent the decay of teeth, but its continued use blackens them. The constant irritation of the mucous membrane sometimes results in oral carcinoma [4]. The fresh nuts are toxic and the toxicity of arecanuts may cause even death [41]. It has been reported from South Africa that chewing of beteluuts had no inhibitory effect on dental caries in South African Indian Children [61].

The processing of the nuts which is still carried out cording to age-old customs requires improvement for esenting better quality nuts combined with palatabi-y. The methods adopted in the preparation of the its to suit the particular taste of any community ries considerably.

It may thus be concluded in certain aspects in regard the biology of the arecanut palm and also the bio-emisty of the husk and the nut, remain yet unexplored ecause of the inadequate knowledge. The present eview is an attempt to bring into focus these aspects.

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