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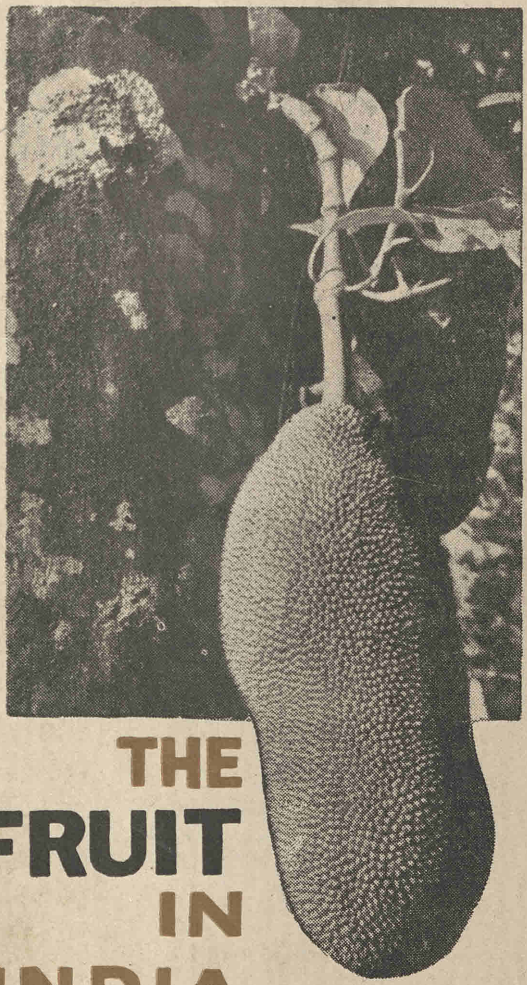

THE JACKFRUIT IN INDIA

INDIAN COUNCIL OF AGRICULTURAL RESEARCH
NEW DELHI

Farm Bulletin (New Series) No. 34

Meant for progressive farmers and others interested in agriculture, the I. C. A. R. farm bulletins are written in as simple a language as a technical subject would permit. These low-priced handy publications aim, among other things, at explaining authoritatively the latest methods for the better cultivation of important Indian crops, adoption of which is essential for increasing agricultural production in our country. This bulletin deals with the various aspects of jackfruit cultivation.

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THE JACKFRUIT
IN INDIA

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AREA AND DISTRIBUTION

THE JACKFRUIT *(Artocarpus heterophyllus* Lam.*)*, one of the popular fruits of India, is believed to be indigenous to this country. It is grown extensively in the west coast of India, Assam and the warmer parts of the country, especially in West Bengal, Bihar and the Deccan. It is also grown in East Pakistan, Ceylon, Burma, Malaya and Brazil. It is also found wild. The name 'jack' is said to be an adaptation of the Portuguese 'Jaca', which in turn is believed to have originated from the Malayalam name for the fruit, namely, 'Chakka'. The Portuguese took the jackfruit from the west coast of India to Europe. It is called *Jacque* in French, *Nangka* in Dutch and *Jacatum* in German. Among the other Indian names for this fruit are : *Panasa* (Sanskrit and Telugu), *Kathal* (Hindi), *Kaathal* (Bengali), *Phanas* (Marathi), *Pala* (Tamil), *Halasu* (Kannada).

It grows from 1,500 m above sea level, though fruits grown above 1,200 m are inferior in taste. It revels in a moist tropical climate, although the warmer plains of South India and the west coast are equally suitable provided adequate soil moisture is available. Soil drainage is of the greatest importance to the jack. It shall not grow well in and around irrigation-project areas suffering from a sudden rise in water-table. The tree is a good shade bearer but thrives in the open. It is sensitive to drought and frost.

The total area under jackfruit is estimated to be 16,000 ha, Assam claiming the largest share of 8,000 ha followed by Bihar and Kerala with 14,000 ha and 2,400 ha respectively. The states of Madras, Mysore and Andhra Pradesh account for the rest of the area, while Uttar Pradesh has only about 260 ha under jackfruit. Although the jack is widespread in the west coast and in other parts of South India, it is seldom planted on an orchard scale, but is found in mixed plantations of coconut, arecanut and cashew.

FORMS

There are no distinct varieties in jack because of seed propagation, due to which the existing plantations show considerable variation from tree to tree in yield, size, shape and quality of fruits. However, the cultivated jacks are broadly classified into two categories ; those bearing fruits with a firm flesh and those with a soft flesh. The former produces a dull thud when sounded and the latter yields to the pressure of a finger when fully ripe. It is considered less sweet than the former. There are several subforms differing in taste, shape and fruit size or edible parts, odour, etc.

A third type called Rudrakshi grows in South India. It maintains its characteristics even under seed propagation. The fruits of this type are small with a smooth and less spiny rind than those of the common jack. The edible parts are fleshy but the quality is poor.

A new type called Singapore or Ceylon jack was introduced in Madras State in 1947. This is remarkable for early bearing. One of the seedlings of this type planted at the Kallar Fruit Station bore fruit in 42 months. The fruit is medium-sized, weighing about 7 to 10 kg. The flesh is sweet and crisp, the bulbs

compact, yellow and firm and the aroma strong. The fruit contains about 80 seeds.

At the Kallar Fruit Station hybridization to combine the qualities of the Singapore jack with those of the local types has been done and 11 such seedling hybrid progenies were obtained and planted in 1952. In 1962, ten years after planting, six of these progenies yielded 30 fruits, the average weight of fruit per tree being 43.3 kg (95.4 lb). The hybrids resembled the female parent, that is, Singapore jack, in fruit characters.

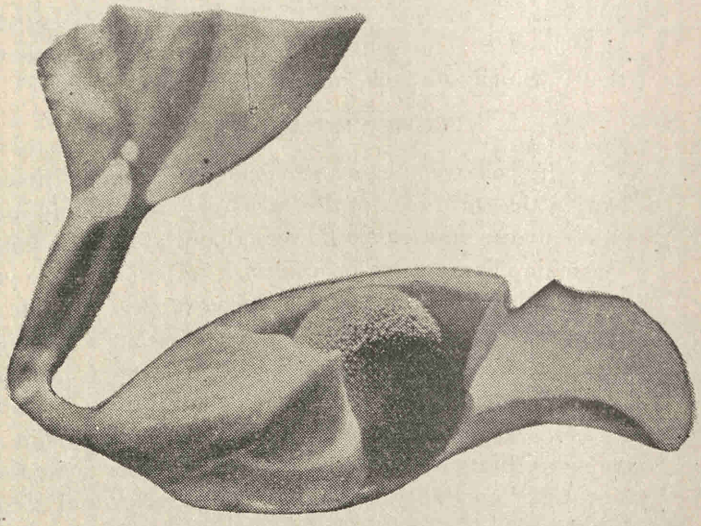
FLOWERING AND FRUITING

The jack tree bears both male and female flowers. During the early part of the flowering season only male spikes appear and female flowers follow later in the season. The male phase occurs for a fairly long period in the year while both male and female spikes appear in one or more seasons. The male spikes drop about a fortnight after their emergence. This condition is often mistaken for a defect in the tree but actually it is perfectly normal. The male flowers develop from the main or secondary branches while the female flowers arise from 'foot stalks' on the trunk and also on primary and secondary branches. The jackfruit is composed of a large number of individual flowers and the fruit therefore is called a 'multiple fruit.'

Seedlings of jack come to bearing in four to eight years, but in North India the trees take a longer time. The Singapore jack is reported to have come to bearing in 18 months under favourable conditions such as under the low wet zone of Ceylon but takes nearly two years at the higher elevations. At the Kallar Fruit Station four out of the 12 trees of this variety flowered when three years old, of which one yielded fruits 42 months after

planting. By then the tree was about 5 m high, with a spread of $2\frac{1}{4}$ m and stem girth of 40 cm.

Summer is the season for jackfruit both in North and South India, but in more tropical regions the fruits are harvested throughout the year.



Emergence of female inflorescence

Fruits are oval or oblong, 30 to 60 cm in length and 15 to 30 cm in diameter. Yields may range from a few to 250 fruits per tree per year. At the Kallar Fruit Station an average yield of 51 kg (112 lb) per tree was recorded from an eight-year-old plantation and at Burliar a 12-year-old plantation yielded on an average 57 kg (125 lb) per tree.

2

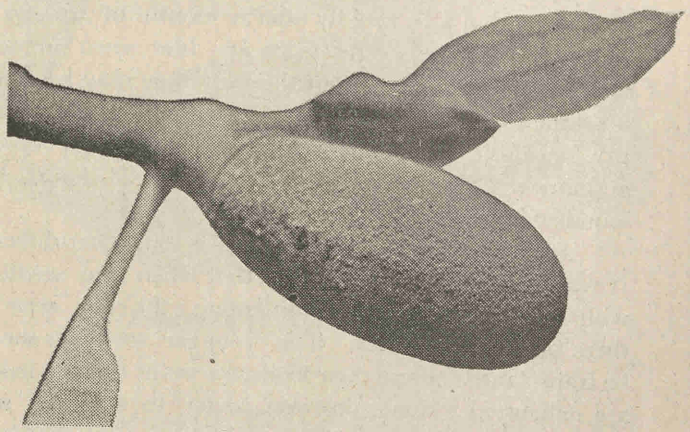
PROPAGATION

THE JACK IS commonly propagated by seed in India and in other countries. Table varieties contain about 100 seeds while inferior culinary types may have even 500 seeds. Seeds weighing 3 to 6 gm are good, while those less than 3 gm are not desirable. The seeds germinate in three to eight weeks.

Jack seeds are not viable for long. The percentage of germination falls rapidly after a month of storage at room temperature. The seeds are best sown immediately. After extraction from the fruit they may be stored for some time in coir dust or sand without loss of viability, but if the cotyledons dry and shrivel they do not germinate. Soaking seeds in water for 24 hours was found to improve their germination.

Transplanting of jack seedlings is somewhat difficult. It was found in one experiment that when the seedlings with four leaves were transplanted, 20 per cent of them became casualties. The younger seedlings should be transplanted before their food reserves in the cotyledons are exhausted. Some growers prefer to sow the seed in the permanent site. The seeds may also germinate satisfactorily in pieces of coconut husk containing enough soil to cover the seed and planted in the field with the husk. The seedlings do not remain healthy for more than a month or two in containers such as bamboo baskets or earthen pots.

Among the methods of vegetative propagation, air-layering has been tried extensively, but has not yielded uniformly good results. In one experiment in Kanpur 60 per cent of the treated shoots rooted. The method consisted of selecting a two- or three-year old shoot from which a ring of bark 5 to 7 cm wide is removed. The cut is covered with clean sand and is kept moist for about 75 days. As roots emerge, a layer of leaf mould is applied and a notch made for the separation of the layer. Those planted in pots became dormant and withered, but those planted in a shaded nursery grew satisfactorily. Moist *Sphagnum* moss, coir husk, coir dust, fine wood shavings, etc., can also be used as rooting media for air-



Fully emerged female inflorescence

layering. Growth-regulating chemicals or hormones such as indole butyric acid, napthalene acetic acid, indole acetic acid, etc., are also used to induce rooting in the

layers. Application of Seradix (a proprietary product containing indole butyric acid) over the cut surface of the shoot has been found to give a success of 72 per cent and that of α-napthalene acetic acid 60 per cent.

In recent times the use of polythene (plastic) wrappers has become very common for wrapping the layered shoots. These films, which are available in several grades of thickness, can retain moisture for long periods so that there is no need to water the treated portion until the day of separation of the layer from the parent tree as is done in the case of the common *gootee* layering.

Budding and grafting are also employed for propagating jack. In Java the modified Forkert method has been successfully employed for propagating jack on rootstocks of jack and two other wild species. This method is also adopted in Ceylon. However, these budded trees are reported to take almost the same period as the seedlings to bear fruit. The only advantage is that the plants are true to parent. They are of no value for timber because of their low-branching habit.

Among the methods of grafting, the common inarching has proved to be more useful. The trials at the Kallar Fruit Station in Madras State have shown that jack grafts can be produced on their own roots besides Rudrakshi and a wild species *Artocarpus hirsuta*. On the Rudrakshi stock the yields were both earlier and heavier than those on the other two stocks.

For preparing grafts the seedlings of jack are raised in pots at the outset or in beds and then transferred to pots while still young. When the seedlings attain the size of a pencil (6 to 12 months), they are used for grafting to selected shoots of the same size on the scion tree.

The actual process consists of removing a piece of bark with a little wood attached about 2.5 to 5 cm long equally on both the rootstock and the scion and binding them with twine so that the exposed areas are held together firmly. The graft union may take place in about 30 to 45 days and graft become ready for separation in three to four months. The separation is done in two or three stages. The grafting operation is best done during the cool rainy season. In order to be sure about the quality of fruit, it is better to plant grafts.

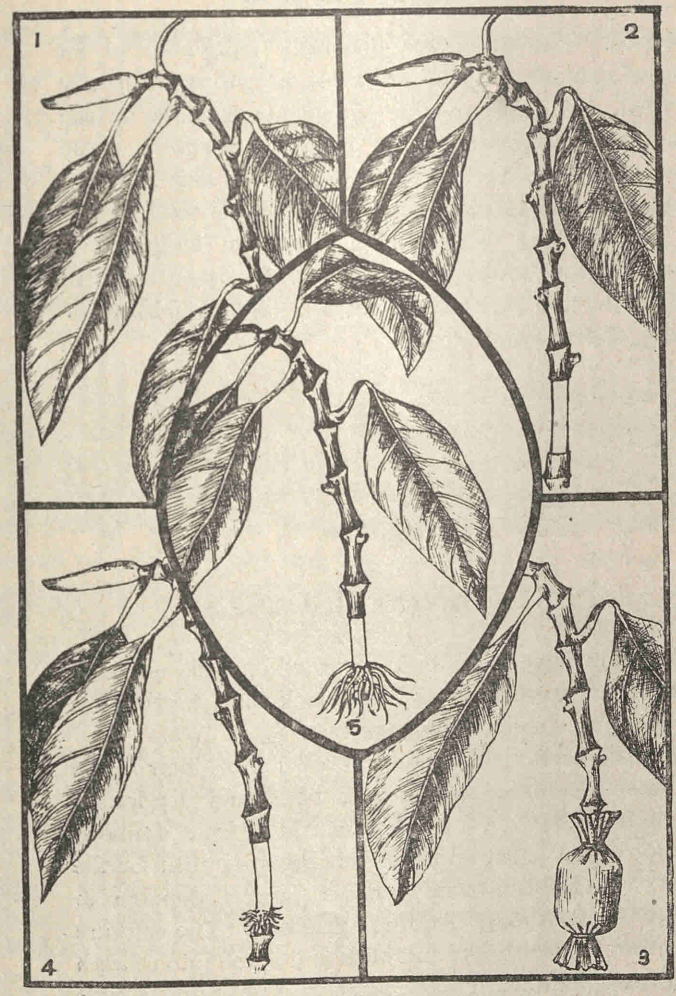
PLANTING

Pits measuring 1 cu m are dug 9 to 12 m apart a month or two before the day of planting and allowed to weather. If the soil is poor, the pits are dug about six months or more in advance. These are filled with two or three basketfuls of well-rotten cattle manure. Grafts are removed from containers and planted carefully so as not to disturb the ball of earth surrounding the roots. Planting is done during June–September in the south-west monsoon areas, extending up to December in the other areas. A cool or cloudy, humid evening is better for planting.

The performance of the grafts planted at the Kallar Fruit Station show that as compared to seedlings the planting of grafts is distinctly advantageous. Apart from the fact that grafts inherit the characters of the parents unlike the seedlings which are variable, the former have also given indications of yielding heavier crops.

CULTURAL REQUIREMENTS

In the West Coast the manuring, irrigation and soil culture are generally not done for jack, as it is grown mixed with crops like arecanut, coffee, cardamom



Stages of air-layering : 1. Selection of shoot. 2. Removal of a ring of bark. 3. Covering with moist moss and wrapping in polythene. 4. Emergence of roots after 30 to 45 days. 5. Ready for separation from mother plant.

or pepper. The latter are generally cultivated in an intensive manner and the jack trees are thus indirectly benefited. No experimental evidence is available on the manurial requirements of the jack. Well-rotten cattle manure will, however, benefit the trees in soils of poor and medium fertility.

Except where water is plentiful the irrigation is necessary throughout the year, as jack is rather sensitive to drought. No cultural practices, like ploughing or digging, appear necessary.

3

PESTS AND DISEASES

SEVEN PESTS have so far been recorded on jack, of which the shoot and fruit borer and the jack bud weevil are somewhat more serious than the rest.

Fruit borer. The reddish brown caterpillar of the fruit borer bores into the shoots, buds and tender or ripening fruits. Even a single insect in a fruit damages the pulp, makes it rot and the fruit becomes unfit for the market. It has been found to cause serious damage in parts of Madras and Andhra Pradesh. The eggs are laid on the tender shoots and buds and hatch into reddish brown caterpillars with black warts and hairs and a pale brown head. Because of the tunnelling activities of the larva the shoots wilt, the buds dry and drop and the fruits begin to rot at the site of attack. The caterpillars pupate inside the holes and emerge as adults which

are brown with grey, elliptical patterns on both the wings.

As the pest feeds on internal tissues, removing the affected portions and shielding the fruits with alkathene bags gives effective control. Spraying the tree before the emergence of new growth flushes and flower buds, with 0.1 per cent DDT once in three weeks (450 gm of 50 per cent wettable DDT in 225 litres of water) may prevent the moths from laying eggs

Jack bud weevil. This weevil is greyish brown in colour. Its small brown grubs bore their way into the tender buds and fruits. In severe cases many inflorescences wither and drop. Spraying DDT as described above should control this pest.

Other pests of jackfruit are the leaf webber, scales, mealy bugs, aphids, a longicorn beetle and the jack spittle bud, all of which can be controlled by contact poisons.

DISEASES

The common diseases of jackfruit are soft rot, leaf spot and pink disease.

Soft rot. It is caused by a fungus which affects the male spikes and young fruits resulting in the premature shedding of young tender fruits. Female spikes and mature fruits are not affected. The grey fungal growth which later turns black is the only early symptom. Moist weather is favourable for the spread of the disease. This can be controlled by spraying the young fruits with 0.4 per cent Bordeaux mixture after every 21 days in January, February and March.

Leaf spots. These spots appear on the leaves resulting in their premature shedding. The disease can be controlled by spraying 1 per cent Bordeaux mixture

or 0.25 per cent copper oxychloride or proprietary products like Cupravit, Phytolon, etc.

Pink disease. It is serious in the West Coast and the Nilgiris. Pinkish or whitish growths are seen on the twigs or branches of affected trees. This incrustation gradually extends and ultimately surrounds the stem and branches arising from it for a length of several feet. The bark splits and peels off under severe conditions. The vigour of the tree is also reduced. The affected parts should be cut off at least 45 cm below the lesion and burnt. The cut surfaces must be protected with Bordeaux paste. Bordeaux mixture (2.75 kg copper sulphate, 1.8 kg lime, 200 litres of water) is sprayed thoroughly to prevent fresh infection.

4

USES

A FULLY RIPE jackfruit is sweet and has a sweet flavour. The bulbs (edible flakes) contain 7.5 per cent sugars on the dry-weight basis and a fair amount of carotene (vitamin A). The seeds are rich in carbohydrates and are also a good source of vitamins B_1 and B_2. Sometimes the bulbs are acidic and leathery in texture. Unripe fruits are also used for culinary purposes. Seeds are cooked and eaten. In some countries the edible pulp of the fruit is taken out and boiled in fresh milk and then strained off. The milk on cooling forms a thick jelly-like substance having a fine orange colour and melon-

like flavour. It has also been suggested that the fruit must be eaten only when fully ripe. Do not take at meal times. A cup of cold water should be taken immediately afterwards ; wine or other fermented drinks should never be taken.

In Kerala several jackfruit preparations are made. The ripe flakes are ground well and boiled, mixed with sugar and honey and preserved as jam. The membranous sheath covering the seed is removed, kept in a salt solution for some days and then sun-dried and preserved. This is fried in oil or ghee like potato chips. Unripe or partially ripe flakes are also used as chips. In Mysore State the ripe flakes are ground with rice and jaggery is added to taste ; this ground dough is spread over breadfruit leaves and baked over steam. An equally popular preparation is the jackfruit 'payasam', a sweet product made out of the ripe fruit boiled with coconut milk and sugar jaggery. Jackfruit 'papads' are also made out of the ripe flakes. Recently it has been shown at the Central Food Technological Research Institute, Mysore, that jackfruit bulbs form a good canned product.

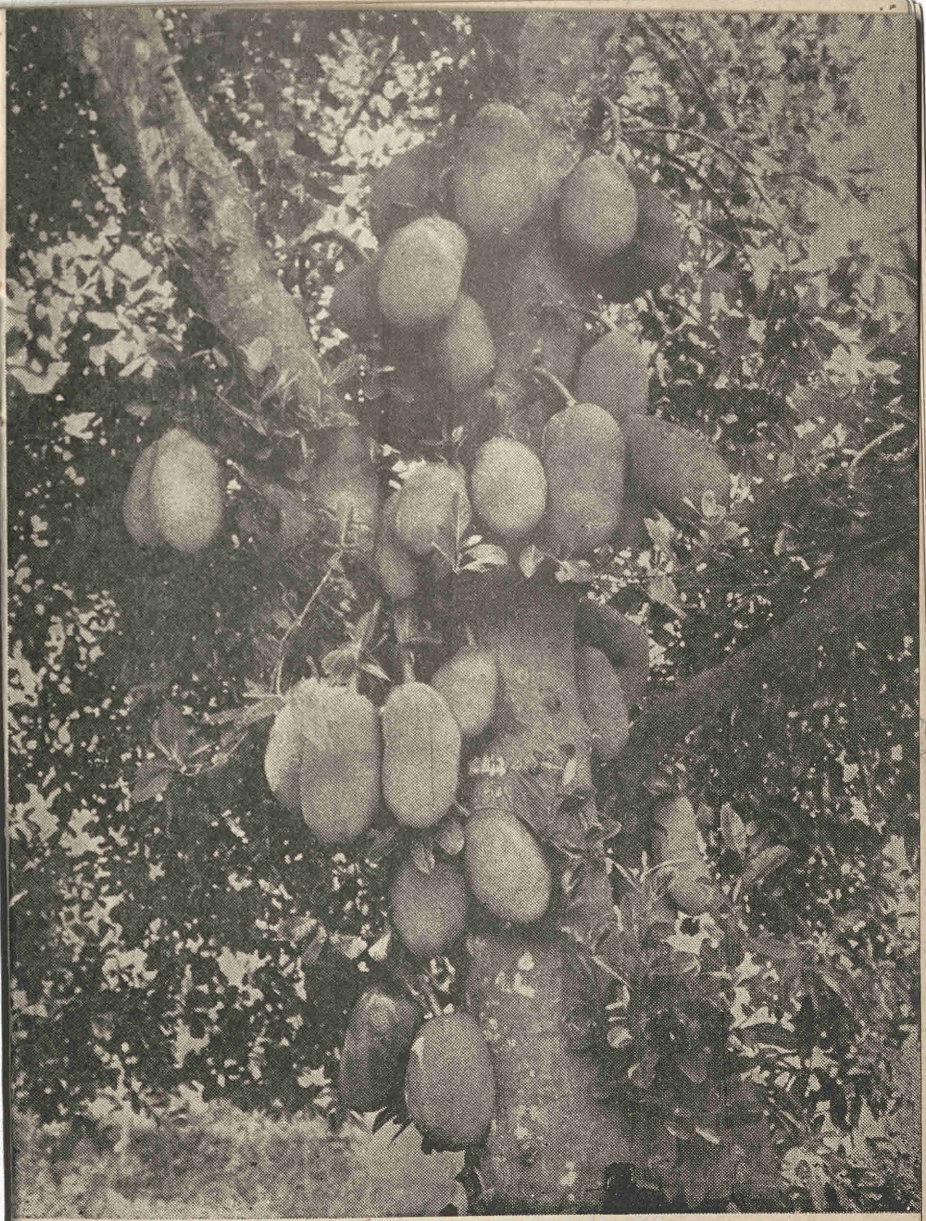
The bark yields a resinous gum, soluble in water. In the west coast of India the latex is used for plugging holes in earthenware pots and *mhote* buckets.

The wood or its sawdust on boiling yields a decoction used as a yellow dye. Both fruit and wood decoctions are used as dyes in West Bengal. The bark also yields fibre.

The wood which is yellow when cut gradually turns brown, is fairly strong, durable and not easily attacked by fungi or white ants. The timber seasons without trouble, is easy to work and takes good polish. It is cheap and excellent in quality, being particularly suitable

for making furniture and musical instruments. In Europe the wood is used for cabinet making and for brush handles, and in some countries in the Far-East it is preferred for the construction of sacred buildings on account of its yellow colour.

The root is used in several medicinal preparations and in Malabar for making toys. The leaves are burnt with maize and coconut shells and the ash used for treatment of ulcers. The bark is a component of poultices prescribed for painful feet and hands and for ulcers.



The jack at its best

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