ISAU - A POTENTIAL TROPICAL LONGAN (DIMOCARPUS LONGAN) OF SARAWAK

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ABSTRAK

Buah longan yang diimpot daripada negeri Thailand adalah sangat disukai oleh pendudok-pendudok Malaysia. Pokok buah ini tidak dapat berbuah dikeadaan tropika di Malaysia. Bagaimanapun di Sarawak terdapat sejenis buah longan yang dikenali sebagai buah ISAU yang mempunyai isi tebal dan rasanya lebih sedap lagi daripada longan yang diimpot. Kertas kerja ini membincang kajian taksonomi, botani, pembiakan dan lain aspek pengeksploitasian buah Isau yang telah dijalankan di Kampus Bintulu, Universiti Pertanian Malaysia.

ABSTRACT

The longan fruit, imported from Thailand, has been much sought by Malaysian. This fruit tree will not bear fruit under the tropical conditions of the Malaysian lowland. However in Sarawak there is a variant of the longan known by the vernacular name of ISAU, the fruit of which possesses thick aril which tastes better than the imported longan. This paper describes some of the results of investigation on the taxonomy, botany, propagation and other aspects of exploitation of the Isau fruit carried out by the Bintulu Campus of Universiti Pertanian Malaysia.

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INTRODUCTION

A recent publication in the New Straits Times (NST July 30, 1988) reveals an eye-catching caption **"DOING ROARING BUSINESS IN 'DRAGON'S EYES'".** It reported that the Year of the Dragon has been one of the best years for the sale of longan which means "dragon's eye" in Chinese or locally better known as "mata kuching" meaning "cat's eye". Fruit vendors have been doing brisk sales of the fruit. Response towards the fruit has been reported to be very good such that one vendor was reported to claim that in all his 15 years as a fruit seller, he thought longan is the easiest to sell and thus most profitable. But, unfortunately, this only comes once a year.

All the longan sold in Malaysia are imported from Thailand where it is grown in the sub-tropical northern region of Chiengmai. It is also grown in the warm temperate region of southern China. For the month of June 1988 it was estimated that a total of 90.7 tonnes of longan was brought into Malaysia from Thailand. The quantity could be higher as the extent of smuggling across the border is not known. Prices of fresh longan vary from $3.00-$5.50 per kilogram in Semenanjung Malaysia and between $6 - $10 in Sarawak. Taking an average price of $4.50 per kilogram of longan and assuming the quantity comsumed for that month of June was 90 tonnes, it is amazing to know that a wooping sum of $405,000 has been spent by the Malaysian public on longan in a single month. If only Malaysia could grow her own longan, the foreign exchange saved would be quite substantial. However, we know that the longan will not fruit under our tropical lowland conditions. Our highland may be possible for longan but there is a limitation of availability of land area. Are there other alternatives?

In Semenanjung Malaysia we have our own varieties of mata kuching, grown in the kampong or backyards and gardens in urban houses. The fruits are small, have thin aril and are of little commercial importance. However, in the course of our search for potential indigenous fruits in Sarawak we came across a commercial variant of the Thai longan. This variant, known locally as 'ISAU' (Iban name) or 'BUA EYAU' (Kelabit name) is grown by the locals or exits wild in the humid tropical forest of the Sarawakian lowlands. It has flesh nearly as thick as the Thai longan but possesses much sweeter taste. Investigation on the Isau and its related races was started by this branch campus of Universiti Pertanian Malaysia since 1986. This paper presents some of the findings on the Isau.

TAXONOMY

Under the family Sapindaceae, the genus Dimocarpus is reported to contain 6 species of trees or shrubs (Leenhouts, 1971, 1973). Five of the species (D.longan, D.dentatus, D.gardneri, D.foveolatus, and D.fumatus) are found in Asia from Sri Lanka and India to East Malaysia; one (D.australianus) exists in Queensland, Australia. The longan belongs to the species Dimocarpus longan Lour. which is synonym to Euphoria longan Stend., Euphoria malaiensis Radlk., Euphoria longana Lam., Nephelium malaiense Griff., and Nephelium longana Cambess (Ochse et al.,1961; Leenhouts,1971; Anon,1986).

Under the species Dimocarpus longan, Leenhouts (1971) distiguished 2 subspecies and 5 botanical varieties using the following keys:

1. Midrib nearly always distinctly sunk above, nerves above nearly always grooved, veins and veinlets clearly different. Petals well-developed, outside hairy, inside fur-like woolly.....subspecies **malesianus**
    2a. Fruit smooth to warty.....variety **malesianus**
    2b. Fruit long-aculeate.....variety **echinatus**

1. Midrib not sunk above, nerves above prominulous, veins and veinlets hardly different. Petals more or less reduced, outside mostly subglabrous, inside sparsely woolly.....subspecies **longan**
    3a. Apex of leaflets rounded, slightly emarginate.....variety **obtusus**
    3b. Apex of leaflets blunt to cuspidate.
        4a. Petiolules 2-10mm; leaflets relatively narrow (ratio 2.5-4.0), base at least in upper leaflets distinstly oblique.....variety **longan**
        4b. Petiolules 8-10mm; leaflets relatively broad (ratio about 2), base equalsided.... .....variety **longepetiolulatus**

The most commonly cultivated taxon is D.longan subspecies longan variety longan, mainly in continental Southeast Asia and Java (Anon, 1986). It may probably be that the longan imported from Thailand belongs to this taxon as the herbarium material of this taxon examined by Leenhouts (1971) was reported to be from Chiengmai and other northern part of Thailand. On the other hand from our examination of the taxonomical characteristics of the Sarawak material, it appears that the latter fits in the description of the taxon D.longan subspecies malesianus variety malesianus. This identification was confirmed by van Welzen et. al (1988) of similar material in Sabah.

VARIATION AND BOTANY

The taxon Dimocarpus longan ssp. malesianus var. malesianus found in Borneo was reported to show the greatest variation, particularly in their vegetative parts and fruits; the flowers are rather uniform (Leenhouts, 1971). The latter estimated a possibility of 30 to 40 local races of this taxon to be in existence. In our examination of this taxon in Sarawak we could roughly group the races into 3 groups, based on their vegetative and fruit characteristics, as well as the vernacular names already given to them. All the members of these 3 groups produced fruits which are warty and the aril is much thicker than the ordinary mata kuching with fruit having smooth surface. Thus our investigation is confined to the members of this taxon with warty fruits. Even within the same group, we have noticed variation in terms of physical sizes of the vegetative parts and fruits. Tables 1 - 3 summarise the characteristics distinguishing these 3 groups.

Table 1. Variation in D.longan ssp. malesianus var. malesianus- descriptive differences of vegetative parts and fruits

Group by vernacular name	Tree form	Leaflet size	Fruit colour when ripe	Fruit aril thick-ness	Seed
ISAU	pyramidal	small	green	thick	small with beak
SAU	straggy	large	green	thick	large
KAKUS	straggy	large	brown	thin	large

Table 2. Variation in D.longan ssp. malesianus var. malesianus- physical properties of fruits

Group	Accession No.	Fruit fresh wt. (g)	Aril fresh wt. (g)	Aril thick-ness (mm)	Peri-carp thick-ness (mm)	Seed fresh wt. (g)
ISAU	13	8.00	3.79	4.0	1.5	1.88
	23	7.99	3.03	4.8	1.3	2.06
	45	4.52	2.68	4.4	0.6	0.97
	46	8.17	3.68	5.2	1.4	1.86
	47	6.04	3.50	4.8	0.7	1.35
	49	7.53	3.93	4.7	1.0	1.79
SAU	12	8.96	3.15	4.2	1.8	2.42
	44	10.22	4.40	4.9	1.4	2.54
KAKUS	14	7.86	3.26	4.4	1.2	2.11
	42	3.36	1.17	3.1	1.0	1.11
THAI LONGAN		11.58	8.07	6.6	1.1	1.55

Table 3. Variation in D.longan ssp. malesianus var. malesianus - nutritive values of fruit aril

Group	Access No.	Moist-ure (%)	Prot-tein (%N *6.25)	Crude fibre (%)	Ash (%)	Brix	Vit. C (mg/ 100g)	Ca (ppm)	Fe
ISAU	13	79.6	1.0	1.6	0.5	22.0	1.7	43.0	3.2
	23	80.5	0.8	0.5	0.6	21.5	1.0	50.4	2.2
	46	79.4	1.0	0.3	0.6	22.0	7.8	40.7	2.7
	49	75.7	1.6	0.5	0.7	24.5	1.1	74.5	1.8
SAU	12	82.8	1.1	1.4	0.6	17.0	1.1	41.0	1.6
KAKUS	14	82.9	1.1	1.1	0.6	19.0	0.9	28.5	1.3

Among the groups of D.longan ssp. malesianus var. malesianus, the fruits of ISAU were found to have higher brix content as well as comparatively higher Vitamin C , Calcium and Iron contents than those of SAU and KAKUS (Table 3). The aril of Isau fruit is also comparatively thicker and less watery in nature than that of the other two groups (Tables 2 and 3). Seed size of Isau fruit is also relatively smaller and can be distinguished from the others by possessing a small beak at one end of the seed. The Isau tree shows a better form and is more pleasant in look the tree of Sau or Kakus.

Thus among the groups of variety malesianus, the Isau shows the greatest potential. We have, therefore, concentrated more of our investigation on this group. The Isau tree can grow up to 40m or more and has trunk up to 1m in diameter. It is always buttressed. Leaves are more often paripinnately compound with an average number of 8.00 to 11.33 leaflets per leaf. The leaflets are entire and oblong elliptical to slightly ovate in shape and are arranged alternately or nearly opposite on the rachis. Length of leaflets ranges from 10.37 - 16.05cm while the maximum breadth of leaflets varies from 2.68 - 4.73cm. Petioles measure from 5.23-9.10cm in length.

The **inflorescence** of the Isau is a panicle measuring about 14-30 cm x 19 - 22cm. It is terminal as well as in the upper leaf axils. **Flowers** are of two types, viz the male flowers where the pistil is rudimentary and the hermophrodite where the staments are less developed. the latter is believed to be acting as female flowers. The flowers are monoecious. The pedicel length varies from 1.5 - 2.5cm. The small flowers range from 3.5 - 6.5mm x 4.6 - 5.4mm. Colour of the flowers is reflected by the yellowish brown colour of the calyx and the white woolly petals. The **calyx** lobes are cuneate (wedge shaped) and five in number and are arranged in imbricate manner. Calyx lobe length ranges from 3.0-4.5mm. **Petals** are free and spathulate in shape and five in number. They are well developed and longer than the sepals (3.5-5.5mm in length). Maximum petal width varies from 0.75 - 1.50mm. They are densely woolly especially on the outer side. The **stamens**, 8 in number, measure from 2.25 - 4.50mm in length. Attachment of filament to anther is basifixed. The lower half of the filament is sparsely woolly. The **pistil** consists of ovary deeply 2-parted, only one of which may grow to form a fruit. The ovary is puberulous to velutinous, becoming slightly warty when growing out; the extended style ranges from 3.0 - 4.5mm. Disc diameter varies from 2.5 - 4.5mm. The **fruits** are always warty and globular. Other characteristics of the fruits are presented in Tables 2 and 3.

Pollination is possibly effected by insects as a number of insects including flies,ants,wasps and bees were seen on the flowers during flowering time. In longan, Crane and Walker (1984) reported that it is self-incompatible and cross pollination may be effected by bees. Isau may be in a similar position.

ORIGIN

The origin of the longan is not clear (Anon, 1986). It grows in southwestern India in the forests of the Western Ghats, from Konkan southwards to the Tinnevelly hills, at up to 1,500m high. It is also very common in the evergreen forests of upper Assam and in the hill districts and may be native to these areas (Anon, 1952). The centre of diversity of the longan is known to be central and southern China (Anon, 1986). However, Leenhouts (1971) states that the youngest centre seems to be Borneo where D. longan shows its greatest diversity. According to him, D. longan may have reached continental Asia from Malaysia; the apparently more primitive subspecies malesianus come as far as Burma.

PRESENT STATUS, DISTRIBUTION AND ECOLOGY

At present the Isau in Sarawak is either grown, from seeds, by the locals or exists wild in the humid tropical forest. When grown, it is in the form of one or a few trees near the longhouses or in the backyard or beside dwelling houses. No proper management of the trees is carried out and so far there is no large scale cultivation of the crop. Most of the Isau are grown along the river bank of the Rajang River; stretching from Kanowit in the Third Division to Song, Kapit and Belaga in the Seventh Division. They are grown mainly on alluvial soil belonging to the Seduau series and also on other soil belonging to the Kapit and Merit series and the Kapit/Merit association. The Isau trees found growing wild are located in the lowland region of Ramudu, Padaleh, Long Lanau and other ares at the foot of the Bario highland. Most of these areas are near the border to the Kalimantan region of Indonesia (Fig. 1).

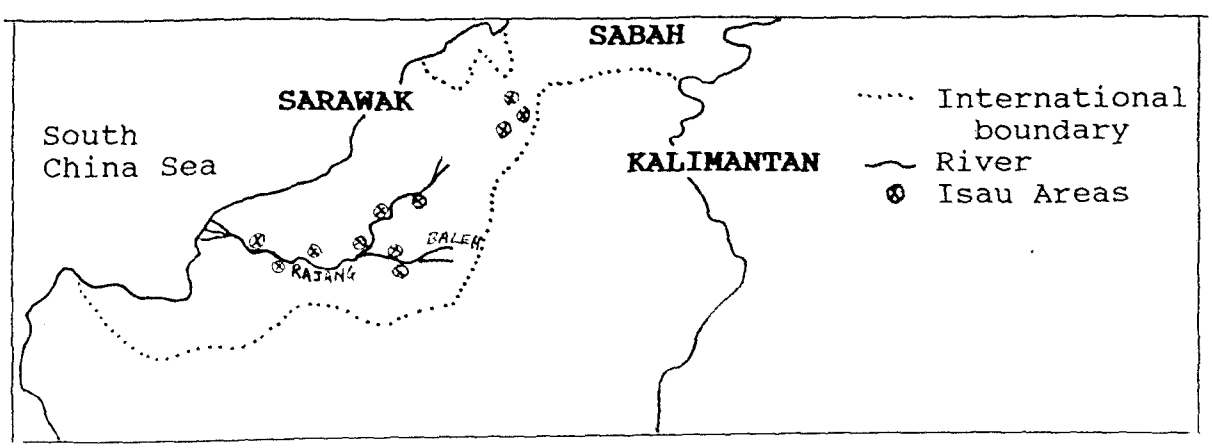

Figure 1. Distribution of Isau in Sarawak.

PROPAGATION

So far all the Isau trees in Sarawak are grown from seeds. As such the trees may take 8 to 12 years before starting to fruit. The Isau seeds are recalcitrant seeds and when stored under normal ambient conditions they lose their germination capacity quickly. In a preliminary storage trial, Isau seeds left exposed to the environment under ambient laboratory conditions for 10 days showed a mean germination of 60% and when left for a further 7 days (i.e. 17 days) under the same conditions they totally lost their viability (Table 4). At this stage the seed moisture content was 31.5%. When sealed in polythene bag and stored in refrigerator, the germination was 86.7% after 10 days storage and 45.0% after 17 days storage (Table 4). At the latter stage the moisture content was 42%. Reports with other recalcitrant tropical seeds indicated that the loss of viability was due to their rapid desiccation (Chin, 1978; Hor et al., 1984). This may also apply to Isau seeds. There would, therefore, be a critical threshold of seed moisture level above which the viability of the seeds can be maintained for a longer period. In a separate trial where the seeds were retained inside mature fruits and stored in cold room at 2 - 3 °C and at a humidity of 40 - 45%, the germination after 21 days of storage was 41.7%. Further work on seed storage and germination will be carried out. This may include the biochemical basis for the desication intolerance in Isau seeds so as to get a better insight into germination and storage problems. The seeds are required to produce seedling stocks for budding and grafting.

Table 4. Preliminary storage trial on seed storage of Isau

Storage conditions	Storage duration (days)	% Germination	% Seed moisture
Ambient (Temp: 22 - 32 °C RH: 76 - 85%)	10	60.0	n.d.
	17	0.0	31.5
Refrigerator - inside sealed polythene bags (Temp: 7 - 13 °C RH: 48 - 56%)	10	86.7	n.d.
	17	45.0	42.0

n.d. = not determined

In order to obtain earlier fruiting, various vegetative propagation methods were tried out on the Isau. Marcotting has given almost 100% success and it takes 9 - 11 weeks for proper root formation before the marcot can be severed from the parent. We have also obtained reasonable success in green budding with seedling stock of diameter of 2.5cm. However, it takes about one and a half years for the stock to reach this size. Rooting of cuttings can be quite difficult - giving about 20% success. Grafting using the wedge grafting as well as the tongue grafting methods have so far not given any success.

HARVESTING AND POST-HARVEST STORAGE OF FRUITS

At present, the harvested Isau fruits are void of stalk when sold in public places. As such they deteriorate rapidly after harvest. Under ambient temperature the pericarp turns brown within one to two days after harvest. Rotting of aril will occurred with further storage under similar condition. This may be an important cause of its slow spread from its growing areas to the rest of the state. It is not surprising that people in Kuching have not heard or seen the fruit because it seldom reached them, at least not in its fresh form. Probably, leaving the stalk on the fruit may prolong the shelf life of the fruit, as has been practised with the longan imported from Thailand.

In a fruit storage trial, it was found that under normal ambient temperatures of 22 - 32°C, browning of the pericarp occurred within 2 days after harvest. At 7 days after harvest, mould was found on the pericarp surface while the aril was starting to ferment. Further storage of up to 10 days, resulted in total rotting of the aril.

Under storage in refrigerator (7 - 13°C) where the fruits are wrapped in newspaper (as moisture absorbent) and sealed in polythene bags, browning of the pericarp can be prevented for up to 7 days of storage. Beyond the storage period increasing pericarp browning was observed until at 14 days when total browning occurred. However, at this stage the taste of the aril was still acceptable. This situation could be extended to as long as 5 weeks of storage. Similar condition was also reported in Litchi (Litchi chinensis Sonn) where pericarp browning did not significantly affect aril quality as measured by sugar, acids and phenol parameters (Paull and Chen, 1987). However, in Isau the maximun storage period under refrigeration as described was found to be not more than 5 weeks after which the usual pearl-white translucent aril started to turn brown.

PEST

One of the worst pests of Isau particularly during fruiting season is the bats or flying fox. They can devour all the ripe fruits on a single tree in a matter of one night. Perhaps in Sarawak there are occurrence of plenty of limestone areas. However, studies have to be carried out to overcome this pest of Isau.

CONCLUSION

Though much still need to be done on the Isau before it can be commercially exploited, the foregoing studies and observations should serve the future development and utilization of Isau as a potential fruit crop in Malaysia. With proper selection and perhaps breeding work, we may be able to make available our own local tropical longan.

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