

INVESTIGATIONS ON SOME NATURAL FOREST PRODUCTS IN NEW GUINEA.

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This article is concerned with a valuable phase of the activities of the Department of Agriculture, which is not generally realized in this Territory. In this connexion some recent findings concerning a few selected examples of native products are considered worthy of publication. It is conceded, however, that some of the information obtained was not encouraging from the commercial aspect.

No. 1.—*Parinari laurina* (=Kusta Nut in New Guinea and Makita in Fiji).—Sir Arthur Hill, Director of Kew, has pointed out⁽⁸⁾ that the above name is now employed in place of *Parinarium laurinum* which was used as the botanical name of this species until quite recently. He has also supplied some valuable information concerning the economic possibilities of utilizing the fruits of this species.

Parinari (*Parinarium*) is a genus of trees belonging to the family *Rosaceae* and found in the tropics generally. There are several species of this genus in the Malay Peninsula, Netherlands Indies, South Sea Islands (including New Guinea, Papua and the British Solomons) Philippines, Fiji and North Australia. According to Burkill,⁽²⁾ oil from the seeds of several African and Brazilian species is expressed.

P. glaberrimum, Hassk, found in Malaya, has an oily seed. This is also found in New Guinea according to Schumann and Lauterbach⁽¹⁴⁾ also *P. arramense* has an oily seed and probably other species have too.

A species *Parinari Hahlii*, Warb, from Ponape, Caroline Islands, was examined by Professor Mannich⁽¹¹⁾ in 1902, and it was stated that "Fett ist in den nüssen nicht enthalten," i.e., "There is no fat contained in the nuts." Tannins were found to be present in the fruit.

Parinarium corymbosum Miq. (*P. Griffithianum*), Benth in Hook, is recorded by Schumann in the Flora of Kaiser Wilhelms-land,⁽¹⁵⁾ as being found in Augusta Station and Lagerburg on the mainland of this Territory. He mentions its distribution in the South Seas and New Guinea and Papua, and also refers to its existence in North Australia. It is also found in Java, Borneo and the Philippine Islands. According to Whitford⁽¹⁹⁾ this is one of the best timber trees of this genus. *P. Griffithianum* is present in New Ireland according to Father Peekel, but is not so common as *P. laurina*.

The *Parinarium glaberrimum* was collected from the mainland and also one of the outlying islands. There is the possibility that *Parinarium myrsinoides* described by Schlechter from New Caledonia and that *Parinarium insularum* may be found here, though they are, as far as known, not recorded.

In a recent work Hill⁽⁷⁾ has shown "that with two exceptions in all other species of the genus, a close-fitting stopper or cork seals the orifice of the seed cavity. On germination the plugs or stoppers are forced out and ejected like corks from a bottle. Two species of *Parinari* have been noticed which do not show this stopper mechanism. *P. glaberrima* Hassk. (*P. laurina* A. Gray) from the Malayan region is one of these, it has much larger fruits than is usual in

the genus; they contain, however, only a single seed, which consists chiefly of the much convoluted, pink, fleshy cotyledons; the radicle splits the fruit open through the scar of the pedicel, but there is no pore or stopper."

It also would appear from this note that *P. glaberrima* is the new name for *P. glaberrimum* which is now regarded as a synonym of *P. laurina*.

Burkill's notes on *P. glaberrimum* are quoted (probably synonymous with *P. laurina*) almost verbatim.⁽²⁾ He states that "this is a tall tree which occurs in Java, Borneo and eastwards in the Pacific, while once it has been obtained from the Malay peninsula in Perak. The timber is hard, very heavy, but not durable in contact with the ground (according to Schneider Bur. For. Philippines). Rumpf gives several uses for the kernel in Amboina. He says *inter alia* that it arrests diarrhoea; and that a paste of it is used for coating the wood of boats that have been attacked by Teredo or ship-worm."

According to Heyne,⁽⁶⁾ Greshoff found 31 per cent. of oil in the seeds. This observation is most interesting as it means that fruits of this species would be worthy of further investigation. Attempts are necessary to get a true botanical identification of the species present in this Territory, and also to collect fruits of the species mentioned here.

On the understanding that the fruits of *Parinari laurina* contained a valuable drying oil the Director of the Imperial Institute, London, very kindly submitted specimens of fruit from New Guinea to a detailed chemical examination. The findings are given verbatim under a separate heading as supplied in a report to this Department.

The following remarks on the Kusta Nut as supplied by Sir Arthur Hill,⁽⁸⁾ in answer to an inquiry from here indicated that the local product was at least worthy of the chemical investigation which he suggested:—

"*Parinari laurina*.—The kernels of this species have recently attracted a certain amount of attention on account of the drying oil they contain, reputed to be not unlike tung oil, and the oil has been the subject of chemical investigation in more than one quarter. It is no doubt the drying properties of the oil which render the masked kernels suitable for stopping holes in canoes and fixing spear-heads by the natives of New Guinea, as stated.

Little appears to be known regarding the potential commercial value of the seeds. In this connexion the following remarks from the Director of the Paint and Varnish Research Station at Teddington, near London, where a small sample of seeds from Fiji was recently examined, may be of interest:—

'With regard to the possibility of using this material within the industry, the question is probably largely one of economics. The amount available was too small to carry out any useful experiments of a practical nature on its application, but the oil was found to body up very easily, and to form a solid gel, like tung oil, but with far greater rapidity. It dried up to a hard film. If such oil were manipulated alone, it might present difficulties, which could, however, be overcome.

Probably if the oil could be produced cheaply, it could be absorbed within the industry, but there is no great chance of a ready-made demand.'

In the Kew Museum collections there are seeds of this species from Fiji, where they are said to be used for scenting coco-nut oil. We are not aware that the qualities of this seed have been investigated from the perfumery standpoint."

W. D. Francis, Botanist at the Botanic Museum and Herbarium, Brisbane, identified specimens of fruits sent to him from this office, in 1935, and originally collected from New Hanover by Mossman, Inspector and Instructor at Kavieng, as *Parinarium laurinum*. Francis stated in his reply that "the natives of Fiji

obtain from the seeds, called 'Buri Nut' or 'Makita' a much esteemed perfume; they also heat the kernels up into a kind of putty which is used for stopping holes in canoes and for fixing spear heads." The kernel is used as a putty by natives in this Territory for similar purposes, but it is not, as far as known, used for preparing a perfume. In Fiji it is said that the perfume is used for scenting coco-nut oil which is used for anointing purposes. It seems that no commercial uses for this perfume are so far known.

Father Peekel, of the Catholic Mission, Ugana, New Ireland, who is also a well-known botanist, kindly supplied the following note:—

"Regarding the genus *Parinarium* I know of only two species here. The common *Parinarium* is *P. laurinum* A. Gr.; the fruit is ovoid, and one celled. The seeds are used, everywhere by the natives, to fill up the fissures of their canoes. The native names are as follows:—Katita, katite, tite, or of similar form. The second species is *P. Griffithianum* Benth. The fruit is oblong and two celled. I have a specimen of this in my herbarium, but the tree is not so common as *P. laurinum*."

It is of interest to note that in Fiji some local varieties of Makita (*Parinari laurina*) are existent. Parham⁽¹⁾ records that the following types were collected in 1931, viz., "*Makita damu*", "*Makita leka*", "*makita dina*" and "*makita salusalu*". It was not stated whether these are varieties or sub-species. This varietal variation would suggest that there would be considerable variation in the production of fruits and contained oils. Such variation, combined with the greater amount of acid decomposition which occurred on the long voyage to England from New Guinea, might quite well account for the differences in oil content recorded between this and fruits from other sources. A search for varieties or sub-species of the kusta nut has not yet been made by this department in New Guinea. If at any time it is considered that the product is worth further investigation this would provide a promising line to pursue.

The kusta nut has been the subject of some inquiry from New Guinea residents. Mr. E. R. Miller, owner of Tsalui Plantation, Lavongai (New Hanover), stated that the trees grow prolifically in the vicinity. It was queried whether the nuts contained any substance of commercial value. The information was also given that Mr. Draper, of Nanianne Plantation, on one occasion forwarded some of these nuts to Brisbane, where the pulp was analysed and was reputed to contain an excellent lacquer.

Mr. J. H. L. Waterhouse kindly collected a sample of kusta nuts, for despatch to England, from a situation close to the native school at Nodup, Rabaul, and also supplied the following notes:—

"It was hoped to secure about a hundredweight of the nuts, but the commodity is much harder to procure than previously imagined. The quantity forwarded should prove enough for small experiments.

The kernel only is used—grated and applied raw to leaks or crevices in canoes after which wood ash is applied. The natives state that without the addition of the ashes the putty is not strong or effective ("ogor") which fact may be helpful in determining its uses."

It was suggested that the outer covering be investigated.

The tree is believed to be a rather shy bearer, but is fairly widely distributed in this Territory. W. A. Mossman, Departmental Inspector, found it difficult to collect fresh nuts, as they germinate quickly in the undergrowth, while the kernel is inclined to disintegrate quickly under rain forest conditions.

The Director of the Imperial Institute,⁽ⁿ⁾ referring to the notes supplied by Mr. Waterhouse, stated—

"We have not investigated the possibility of using the grated kernels, as this would not be a practical issue in the United Kingdom. It is, moreover, not feasible to suggest any commercial use to which the husks of the fruits could be applied, except the possibility that they might be of use in the manufacture of industrial charcoal. This point, however, would not be worth investigation unless large quantities of fruits were available and the kernels themselves were disposed of as oilseeds."

Conclusions.

Among the factors which would militate against the commercial exploitation of the fruits are—

- (a) the apparently very limited supplies;
- (b) the statement that the kernels keep badly.

Parinari Laurina Fruits from New Guinea.

Results of Chemical Investigation by The Imperial Institute (31st August, 1936).

The sample, which is the subject of this report,^(b) was forwarded to the Imperial Institute by the Assistant Director, Royal Botanic Gardens, Kew, in July, 1936, being originally received from the Department of Agriculture, Territory of New Guinea.

DESCRIPTION.

The sample, which weighed $3\frac{1}{2}$ lb., consisted of reddish-brown, roughly oval fruits, varying in size from $2\frac{1}{2}$ inches long by $1\frac{1}{2}$ inches in diameter to $3\frac{1}{2}$ inches long by $2\frac{1}{2}$ inches in diameter. The fruits, as received, were composed of fibrous husk from $\frac{1}{4}$ to $\frac{1}{2}$ inch thick, enclosing a kernel varying in colour from pale purple to chocolate and in consistency from fairly hard to hard. In the case of some kernels, part of the outer surface was covered with a light brown skin.

RESULTS OF EXAMINATION.

The fruits were submitted to examination with the following results:—

Table.

Fruits—

Average weight of a fruit	..	..	..	76.2 grams.
Husk	..	..	..	52.2 per cent.
Kernel	..	..	..	47.8 " "
Oil, expressed on entire fruits	..	..	..	5.7 " "

Kernels—

Average weight	..	..	..	36.4 grams.
Moisture	..	..	..	11.4 per cent.
Oil, in kernels as received	..	..	..	12.0 " "
Oil, expressed on moisture-free kernels	..	..	..	13.6 " "

The oil extracted from the kernels with light petroleum was a pale buff fat of soft consistency. It oxidizes very readily in the air at ordinary temperatures forming a substance which is gelatinous at 100 degrees C., and is not soluble in the unchanged oil. The oil was examined with the following results, which are shown

in comparison with those obtained by Tsujimoto and Koyanagi⁽¹⁷⁾ for the fat of *Parinarium laurinum* (*Jour. Soc. Chem. Ind., Japan, 1933, Vol. 36, suppl. binding p. 110*):—

	Present Sample.	Fat of <i>Parinarium laurinum</i> .
Specific Gravity at 100° C./15.5° C.	0.9025	0.9379 (a)
Refractive Index at 40° C.	1.5429	1.5610 (b)
Melting point	37.1° C. (c)	49-50° C.
Acid value	33.8	1.31
Saponification value	193.7	186.8
Iodine value (Wijs, 1 hr.), per cent.	202.8	214.1
Unsaponifiable Matter, per cent.	1.2	1.15

(a) Density at 50° C./1° C.

(b) At 50° C.

(c) Open tube method.

The foregoing results show that the kernels of these *Parinari laurina* fruits contained only a very low percentage of oil. The oil belongs to the "drying" class of fatty oils. It has been shown by Tsujimoto and Koyanagi, *loc. cit.*, and Farmer and Sutherland,⁽³⁾ *Journ. Chem. Soc., June, 1935, p. 759*, to contain as one of its components a highly unsaturated fatty acid, the presence of which would account for the high iodine value and high refractive index.

REMARKS.

It is unlikely that it would be remunerative to offer kernels of the quality of those in this sample of fruits as a commercial oil-seed, owing to the low yield of oil which they furnished. A much higher yield of oil, viz., 44 per cent., has been recorded by Farmer and Sutherland (*loc. cit.*) for the kernels of this species (country of origin not stated). It is also improbable that the oil could be profitably produced in the Territory for shipment to the United Kingdom especially as it possesses the disadvantage of oxidizing very readily in the air at ordinary temperatures; the expression of the oil from the kernels would therefore have to be carried out under special conditions.

In addition to the low oil content of the kernels, the fact that supplies of the fruits are very limited, and that the kernels are stated not to keep well, render the prospects of commercial utilization unpromising. It is possible that the low yield of oil in the kernels examined may be due in part to deterioration if this sample has aged, and that fresh kernels might contain a higher percentage.

This species and other closely related species, some of which are found in New Guinea, have been the subject of investigations by forestry officers in other countries as a timber product. Burkill (*loc. cit.*) and Ridley⁽¹²⁾ in Malaya and Whitford⁽¹³⁾ in the Philippines are amongst the authors who have discussed the timber possibilities of this group.

Ridley describes *Parinarium griffithianum*, Benth, as a large tree 70 to 80 feet tall with deep green leaves and white flowers, but not very abundant in Malaya. Wood, red with light markings, grain medium, fairly hard, splits very slightly

in drying, durable, weight 49 lb. 8 oz. per cubic foot. He says that according to Van Eden, this is a good timber giving beams 5 inches to 6 inches square. Habitat usually near the sea.

Whitford (*loc. cit.*) says that this is the only tree of the *Rosaceae* of commercial importance in the Philippines, where it is known as Liusin. His comments regarding the wood are that "the sapwood is creamy white in colour; the heart-wood is light reddish brown, very hard, extremely difficult to saw, fine and usually straight grained. It is very durable in contact with salt water. Liusin is especially valuable for piling and is also used for ship-building and house-posts. Other species of the genus *Parinarium* produce wood indistinguishable from Liusin.

Burkill⁽²⁾ quoted Foxworthy⁽⁴⁾ as stating that all the Malayan species of *Parinarium* (including *P. griffithianum*), seem to furnish wood of similar quality. It is pink or reddish in colour, very hard; heavy, fairly durable, but very little used. The wood is sufficiently good to be suitable for posts especially in salt water, but it is subject to dry rot. It is not ordinarily found in large sizes. In some places the wood of various species is not used, or used only for charcoal, on account of its extreme hardness. It seems that these remarks largely apply to New Guinea forests as in most parts the distribution of trees is scattered.

Parinarium laurinum—*Parinari laurina* from the forestry point of view, was described by Lane Poole⁽¹⁰⁾. A specimen from his collection No. 810 is in the department's herbarium as collected from the Mavelo River, Papua.

A small to medium tree 3 feet in girth and 30 feet high. (One authority states that this tree may grow 30 metres high.)

Leaves.—Simple, alternate, on swollen, brown, tomentose petiole (hairy leaf stalk), $\frac{3}{4}$ inch long; blade 5 inches to 10 inches by $1\frac{1}{2}$ inches to 2 inches; lanceolate somewhat oblique, acuminate, Venation prominent, stiff, glabrous and thin.

Fruit.—A very hard, rough, woody fruit, ovoid in shape when ripe 3 inches by 2 inches. When green a flattened ovoid shape. Woody shell 5-16 inch thick; inside a convoluted kernel 2 inches by $1\frac{1}{2}$ inches.

Bark.—One-eighth of an inch thick, brown finely lined, inner bark reddish.

Wood.—Sap white 1 inch, heart light brown. Axes firmly.

Rays.—Very indistinct, 390-400, sinuous around if not broken by pores which cover a width of up to five rays. Indistinct on longitudinal sections. Pores—900 to 2,000 in irregularly scattered clumps; single. Soft tissue. Very fine lines link up the rays; 250 to the inch.

General.—A reddish brown wood with a dense grain. Cuts hard, weight 52 lb. per cubic foot.

Remarks.—The shell of the fruit is grated upon a stem of pandanus and the gratings are used to make caulking for canoes.

According to Schumann and Lauterbach⁽¹⁴⁾ this species was first described by A. Gray⁽⁶⁾ (in *Unit. Stat. Explor. Expedit. of Bot. Wilk. Exp. Vol. 1, page 490*) and it has the following distribution:—Fiji Islands, Solomon Islands, Island of Bougainville, Admiralty Islands (Manus).

The author comments that it is also moderately plentiful on the whole of the Bismarck Archipelago, and is stated to be particularly abundant on Lavongai (New Hanover) Island.

It would appear that it would not be worth while to continue these investigations until some more definite market is available for oils derived from *Parinari*. It is regrettable that there are features other than the actual oil content of the fruits, which mitigate against the use of the product for commercial purposes.

One potential use, however, is the utilization of oil-bearing species of *Parinari* for schemes of re-forestation in the tropics, where this becomes necessary. In that case it would be necessary for a local chemist to examine each individual variety and species, until those with the highest yield, oil content and best timber possibilities are isolated.

It is intended to discuss the possibilities of exploiting some other natural forest products in future publications of the *Agricultural Gazette*.

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