

Krabao in Siam.

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THE seeds of species of *Hydnocarpus* (including *Taraktogenos*) have been used in the treatment of leprosy in India and China for some hundreds of years.

India obtained her supply of these seeds from Assam. The history of this supply, and its derivation from *Hydnocarpus* (*Taraktogenos*) *Kurzii*, is well known. The origin of China's supply is, however, not so well known, though the chief facts have now been ascertained.

It is true that it has long been known that Siam supplied China with these seeds, the Chinese designation for which is ta-feng-tzu, but it was not known from what species they were derived. Daniel Hanbury had some seeds sent to him, and he figures them in his "Notes on Chinese Materia Medica" (1862), where, after stating that the seeds were imported from Siam, he remarks that "the plant affording these seeds is not well ascertained." He goes on to point out their resemblance to those of *chaulmoogra odorata*, but decides that they belonged to a different species. Later writers on the subject were not always so circumspect. B. E. Read, however, has since demonstrated (China Medical Journal, 1922) that the seeds imported into China are those of *hydnocarpus anthelminthica*.

The word "krabao" is used in the title of this article, rather than "chaulmoogra," in order to avoid confusion with the true chaulmoogra, *Hydnocarpus* (*Taraktogenos*) *Kurzii*. Krabao is a name applied, both in Siam and Cambodia, to *hydnocarpus anthelminthica*, as well as other species of *hydnocarpus*. The seeds of krabao are known in Siam as luk krabao; in China as ta-feng-tzu or ta-fung-chi.

So many forms of, and combinations including the word krabao have been used that it will be well to consider a few of these before going further. One of the first references to the seeds of krabao is in the best known of the Chinese pharmacopoeias, the Pen t'sao kan mu, completed in 1578,

whose author mentions that they come from Siam, and gives a Siamese name for them, which has been rendered lu-brako. Other variants of the name that have appeared in various works are, lucrabau, lukrabao, lukraban and cukraban. Another name, used by some authors is mai krabao. The word mai means tree, so the term mai krabao is simply the krabao tree.

Hydnocarpus anthelminthica is widely distributed in Siam and extends eastwards to Cambodia, Laos and Annam. Recently it has been reported from Myitkyina in Upper Burma. In Siam it is found here and there all over the country, except in the extreme south, its southern limit being about Lat. 8°, 50 N. The species is most plentiful in central and eastern Siam. Its favourite habitat is the immediate vicinity of rivers and creeks running through level, low-lying country. These situations are liable to be flooded at intervals during the rains, while in the dry season the river may shrink to a sluggish, nearly stagnant stream, or a series of unconnected water-holes. The soil in such situations is practically always a sandy loam. Occasionally the tree is found in another, and very different habitat, on mountain slopes and valleys, but in such places it is not so abundant as along water-courses in the plains. About January seems to be the general flowering time, but it is not at all uncommon to find trees in flower at other seasons. The rather small pale green flowers are sweetly scented, emitting a refreshing fragrance which pervades the atmosphere in the neighbourhood of flowering trees. The flowering stage of the tree has a special name "ka long," or "the infatuated crow," presumably meaning that the fragrance will even appeal to a crow. The male and female flowers are distinct, but both are produced on the same tree, the male in far greater abundance than the female. The fruit ripens about August and September.

In a good year the trees may bear quite heavy crops of fruit. Some years ago the crop on a medium sized tree was carefully picked and found to contain 648 fruit. Such a crop should yield seven or eight litres of ethyl esters, sufficient to treat 50 lepers for one year. It would, however, be unsafe to regard this as an average crop for a single tree. In any one year there are always to be seen some trees which have not fruited at all; while in certain years, particularly when the rainfall is deficient, the whole crop is poor. The mature fruit is more or less globular and measures up to about 47 cm. in circumference. It contains on an average 60 seeds, embedded in a mealy pulp.

Though *hydnocarpus anthelminthica* is so widely spread in Siam, only a comparatively small area has been tapped for the export of seeds. If the demand increases the crop can be obtained from a much wider area. The trees in these areas are so plentiful that there is no temptation to pick other seeds as adulterants, nor are there any other seeds at all resembling them in such localities. The danger to be guarded against is old seeds; if the market is not good the seed merchants are apt to keep the seeds over till the next year, when many of them will have their kernels discoloured and rancid. In Bangkok, the Siam Medicinal Oil Works, of which Mr. H. Olesen is the proprietor, expresses the oil, with modern machinery, from carefully selected seed. The most convenient way, no doubt, is to buy the oil rather than the seed, and save weight on useless shell. The oil, too, keeps in good condition much longer than seeds will.

Though "Lukkrabao" have been exported from Bangkok for centuries, it is for only comparatively recent years that figures of the amount exported are available. The first year for which returns have been seen is that of 1899, when 251 piculs of seed were exported to China. A picul is approximately .06 ton, or 60 kilogrammes, so that 251 piculs represents about 15 tons. The estimated value of this was Ticals 300. The early exports recorded remained below 1,000 piculs a year, till the year 1907-1908, when the export was 1,320 piculs. Since then the annual export of seeds, though fluctuating considerably, has only dropped below the 1,000 picul mark on four occasions, and, in 1919-1920, has reached as high as 8,965 piculs, or about 533 tons, valued at Ticals 38,031. In the five years ending March 31st, 1930, the average annual export of seeds from Bangkok was 3,777 piculs, valued at Ticals 16,971; this represents about 219 tons valued at £1,520, taking the tical at its present rate, 1s. 9½d. The estimated value per picul of the seeds fluctuates within wide limits; in the past five years it has varied from Tcs. 2.70 to Tcs. 6.52; though within that period the value of the tical, which is now on a gold exchange basis has remained steady.

The bulk of the export of these seeds goes to Hongkong, and other Chinese ports, a small amount occasionally going to Singapore; but in recent years there has been a small export to other countries, such as the British Malay States, India, Philippines, Union of South Africa and Portuguese South-east Africa. Though Japan rarely appears in the custom's returns as getting shipments of Krabao seeds, it is known that she does get her seeds from Siam, but indirectly

through China ports. Possibly other countries get indirect shipments in a similar way.

While in China the seeds are chiefly used in the treatment of leprosy and skin diseases, this does not seem to have been the case in Siam, at any rate in olden times. In looking through several old collections of Siamese prescriptions it was rare to find luk krabao mentioned in connection with either leprosy or skin diseases; though they are frequently mentioned in prescriptions for other diseases.

Various other parts of the tree are also used as drugs. A modern work on Siamese medicine gives the medicinal uses of the different parts of the tree as follows:—

Leaves for incised and penetrating wounds.

Flowers for skin diseases.

Seeds for leprosy and ulcerations.

Bark for mucous discharges.

Heartwood for nasal discharges.

Root for foetid mucous discharges.

The different parts of the tree given above may be used internally, chiefly as decoctions and pills, or externally, as ointments and lotions. The prescriptions for these always contain a large number of other ingredients besides krabao.

The name *anthelminthica* would suggest that some part of the plant is used as an anthelmintic; but no such use of it has been heard of in Siam.

Fish eating the fruit that fall into the water are said to be poisoned, and when so poisoned, they are not fit for food. A similar property is recorded for the seeds of *hydnocarpus venenata* in India.

The pulp of the fruit is edible, but rather dry and tasteless. When eaten with coco-nut milk and sugar it is considered quite palatable. On occasion, it is said, outlaws and persons lost in the forest, have been able to subsist for several days on this pulp. Only the pulp of quite ripe fruit can be eaten. The pulp of unripe fruit, when freshly opened, has a distinct smell of prussic acid.

Several other species of *hydnocarpus* are found in Siam, but, with one exception, they need not be considered here, as they are not at present of commercial importance.

The exception is the true chaulmoogra, or *hydnocarpus (taraktogenos) kurzii*. It has been found in several provinces in the north of Siam and also in a few places in the Peninsula. Unfortunately, most of the places where it grows are rather inaccessible, and it is usually not in great abundance in these localities. One of the best forests for it is near where

the southern boundaries of the provinces of Lampang and Prê meet. In this forest it is estimated that there are some 5,000 mature trees, which might yield a crop of 100 piculs, or six tons, of seeds in a year. This tree is also called krabao in Siamese, but sometimes the word dong (virgin forest) is added to distinguish it from *hydnocarpus anthelminthica*.

In conclusion it may be said that the annual crop of seeds yielded by trees of *hydnocarpus anthelminthica* in Siam is sufficient to treat a very large proportion of the lepers in the world ; that the seeds are easily obtained, and that there is at present no fear of adulteration. It would, however, be more economical to have the seeds pressed in Bangkok, and only the oil shipped.