

STUDIES OF CHINESE BAMBOOS. I.
A NEW SPECIES OF ARUNDINARIA
FROM SOUTHERN CHINA¹

Part 2. Notes on Culture, Preparation for Market, and Uses

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Tea Stick Bamboo is so excellently adapted to a wide range of uses that it occupies a prominent place in the everyday life of the people of this region, and doubtless one or another of its various local names is familiar to nearly every Chinese in the provinces of Kwangtung and Kwangsi.

As one walks through a street in China or along a waterfront at which boat dwellers anchor their craft, one of the commonest sights that greets his eye is that of "laundry" spread on bamboo poles and floating in the breezes. In Chinese gardens the tender stems of herbaceous plants are held upright in spite of wind and rain, being firmly but inconspicuously bound to slender bamboo stakes thrust into the ground. The Chinese carpenter, ever with an eye to economy, fastens narrow boards together edge to edge with bamboo nails in preference to the use of more costly, wider pieces. The windows of many shops and dwelling houses of the more humble folk are fitted with bamboo bars to prevent the too easy entrance of sneak thieves. These bars are often painted black in imitation of iron, and the likeness is so great that a casual observer not familiar with the facts would not notice the difference. Curiously, in well-to-do homes, where real iron bars are used for the same purpose, they are sometimes painted to resemble bamboo! Within the homes, various objects will be found which are always made of bamboo—such as the baby's pen or play chair, kitchen stools, poles for suspending the mosquito nets, umbrella handles, etc., etc.

¹ Part 1 of this study (Lingnan Sci. Jour. Vol. 10, No. 1) was devoted to a diagnosis of this form under the name *Arundinaria amabilis*. In view of the distinctness of this bamboo and of the unwieldiness of such long names, I propose to use in this paper the English equivalent of the most widely current vernacular name for it, namely Ch'a Kon Chuk (茶桿竹) which being translated, means "Tea Stick Bamboo". The names Sha Paak Chuk (沙白竹), Sand White Bamboo, and Ah Paak Chuk (亞白竹) are also used in the country where this bamboo is grown, but not elsewhere. The local foreign dealers in this bamboo refer to it as Ts'ing Lei Chuk (青籬竹). The term "Tonkin Cane" used for this bamboo in the United States is a misnomer and is therefore disregarded here.

For the various purposes just mentioned, as well as for many others, Tea Stick Bamboo is ideally suited by virtue of the straightness, stiffness and toughness of its stems, their relative lack of taper, and the smoothness of the joints.

These same virtues have been discovered by Western peoples and, as a result, the demand for this bamboo for export is so great that the supply is never enough to meet it, and the price of the better grades is too high to permit their general use locally.

Western peoples find this bamboo ideally adapted to the manufacture of the highest quality split-bamboo fishing rods. It is also extensively used for handles of various tools such as collecting nets where there is need to combine lightness with strength. Although the uses to which this bamboo is put in the West cannot compare in number with those found for it in China, it is probable that the aggregate cash value of the products made from it in Western countries is greater than that of those made in China. Even the annual output of fine fishing rods alone probably sells for as much as the total annual crop of Tea Stick Bamboo brings in China.

As a matter of fact, the total production of the true Tea Stick Bamboo is not great. Its culture is apparently confined for some undiscovered reason, to a rather limited area, oval in shape, probably not more than 25 English miles in length, and centering in the little village of Au Tsai in the district of Wai Tsaap, Kwangsi province.² The region embraces also a small part of the adjacent district of Kwong Ning in Kwangtung province.³ The extent of the present known distribution of this bamboo is shown in a sketch map, Plate 8, in part one of this paper.⁴

So far as our present information goes, Tea Stick Bamboo is known only in cultivation. The region in which it is found is a part of a much larger area, extending from above Au Tsai in a southeasterly direction along the Sui River, to and beyond the city of Sz Ooi (四會), throughout which bamboo is the leading crop. Even the scant areas of bottom land are mostly planted to bamboo rather than to rice. And while bamboo and bamboo products constitute the chief export from this region, rice must be imported. In the immediate area in which Tea Stick Bamboo is grown, several other kinds of bamboo of economic importance are also produced. It is estimated that Tea Stick Bamboo occupies about half of the land devoted to bamboo culture in this limited area.

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⁴ Lingnan Sci. Jour., Vol. 10, No. 1.

The groves of this bamboo are usually confined to hillside land (fig. 2), and there seems to be no preference exhibited as far as direction of exposure is concerned. Its culms stand stiffly upright even to the tip and are clothed in short, ascending branches and heavy, dark green foliage. The austerity and magnificence of Tea Stick Bamboo are in striking contrast with the feathery, nodding, ethereal habit of the other, more common bamboos in the vicinity.

Method of Culture

For the establishment of a new plantation an area which has lain fallow for a period is preferred. The land is prepared by clearing off all of the wild vegetation. The preliminary act is to burn the grass and other herbaceous plants. This is done in the winter when the vegetation has become more or less parched by a prolonged period of rainless weather. After this burning, all the wood of value is salvaged and the soil is cleared of roots. These latter are then often burned on the spot, the ash contributing to the fertility of the soil. It is calculated to have the land in readiness for planting in accordance with the Chinese traditional advice: "Ch'ing uet chuk; yi uet muk" which, being translated, is "Plant bamboos in the first month; other woody plants in the second." The first month of the Chinese lunar calendar usually falls at least partly in February.

As the clearing is completed, holes are dug in random order at distances of from six to ten feet. Each hole is only large enough to accommodate the new plant, no effort being made to loosen the earth at the bottom. The plants are then dug up from an established grove. Propagating material for this type of bamboo consists of clumps of one or two upright culms with a foot long portion of the rhizome attached. The upright portion as well as the rhizome should be of relatively recent growth, preferably between one and two years old. Care is observed to avoid disturbing seriously the attachment between the two. The rhizome must have some viable buds from which new rhizomes and new culms may develop. Likewise, the culms are selected which have leafy branches at the nodes within about 2 or 3 feet of the ground. The portion of the culms above this point is lopped off with a sharp knife, partly to decrease the transpiration rate and partly to reduce the leverage which the wind can exert upon the stem when it has been planted in the open (fig. 1).

During the planting process great care is taken to tamp the earth snugly about the rhizome and all underground parts of the new plant. This insures intimate contact with the soil, and so with the moisture supply, and makes for optimum conditions for continued delivery of soil water. The last inch or so of soil is then thrown on loosely and not tamped. Natural rainfall is

depended upon for the watering of the plants and rarely, if ever, is water carried to them. A companion crop, such as cassava,⁵ is often put in along with the bamboo in order to make use of the surplus available fertility and provide a cash crop to help cover the cost of planting the grove.

There is usually little sign of growth the first year, with the exception of a few new leaves produced on new secondary branches. The appearances are deceitful, however, for the underground part of the plant is steadily growing and extending itself. And in the spring at the end of the first year a few new shoots are sometimes produced. In my own experience at growing this bamboo, however, no shoots were produced at the end of the first year, but in the second spring some plants sent up as many as thirty new shoots at once (fig. 3).

The impression conveyed to me by the growers questioned is that it takes a grove of this bamboo about ten years to reach its maturity, that is, to produce culms of the maximum size for any given piece of land. Each year the rhizomes spread farther and farther in every direction from the parent plant, and each year the new culms reach a loftier stature, until the mature size is reached. The maximum size to which the culms of a given grove will attain is limited by the nature of the substratum upon which it grows—the natural fertility and penetrability of the soil and the moisture supply. No fertilizer is applied to the groves, as a rule.

The largest culm of this bamboo which I have found was in a magnificent, apparently mature grove on a gentle slope in the vicinity of Au Tsai. The soil was a rich, brown, friable loam of great depth. The rhizomes formed their network some twenty inches and more below the surface of the ground. This specimen (listed in our culm collection as BC-69) was 13 meters in height and 5.7 cm in diameter, with 44 nodes above the ground. Culms of this size bring more than a dollar each, wholesale. The average culm, however, is probably less than half this large.

The average life of a grove under the varying conditions of soil and harvesting is said to be about forty years. It is probable, however, that many areas are harvested for considerably longer periods. In fact, I have not seen any abandoned groves of this bamboo or any that were being dug up. Only two possible causes of such an eventuality occur to me at present. The network of rhizomes might conceivably accumulate to such an extent that, either by actual physical obstruction, or by the deposition, by decay, of substances unfavorable to the health of the plants, growth would be hindered perceptibly.

⁵ *Manihot utilissima* Pohl, called in Cantonese, Faan Kwai Shue (番鬼薯).

Effect of Flowering on Vegetative Growth

In April, 1925, I observed that flowering culms of this bamboo had appeared in certain groves in the vicinity of Au Tsai, Kwangsi. Returning in 1928 I found the flowering still going on, and apparently more widespread. In 1929 a third trip was made, at which time a splendid series of flowering specimens was secured from the vicinity of Koo Shui, (崗水), an adjacent locality in Kwangtung. This latter place had been visited in 1925, but no signs of flowering were observed at that time. The plants which flowered did not die, however, but exhibited a progressive suppression of the vegetative activity lasting over a period of several years. Individual culms which flowered gradually dried up, producing fewer and fewer leaves in successive seasons. The vegetative activity of the rhizomes, moreover, was distinctly suppressed, no vigorous vegetative culms being produced but only flowering ones of progressively reduced size. That a given grove would, in the course of time, fully regain its former vegetative activity is vouched for by the fact that the planters were not destroying the groves in which flowering occurred, saying that, as compared with a newly set out grove the former would sooner be in a profitable productive state. More direct evidence of this ability of the plants to recover eventually their vegetative vigor may be given from my own observations. In 1928 I succeeded in securing from near Au Tsai six small living clumps of this bamboo, several of which were in a flowering condition. I planted them in pots and watched their behavior, especially that of the flowering ones. They produced flowers each spring (during March and April) but only on short, much dwarfed branches arising from the rhizomes and from the old culms, there being no normal culms produced. In the spring of this year (1931), however, the plants began to recover their vegetative activity, and there was at the same time a distinct decline—almost a complete disappearance, in fact—of the flowering. One plant produced this spring the first shoot of any size (about a meter in height) which it has produced in several years. It sent up also two others, one about six inches and the other about eight inches in height, exclusive of the length of the terminal leaves. At the same time only four meager inflorescences were produced, one with one spike, one with two, one with three and one with five, all but the latter being hidden among the foliage. It is obvious, from the foregoing, that the planter will, when securing young plants for a new grove, go to a grove which he knows to be in full vegetative vigor.

The epidemic of flowering which struck the groves of Tea Stick Bamboo in recent years has obviously caused a great financial loss to the planters. Furthermore, the exporters

admit a serious reduction in the total production during the past few years.

As to the probable duration of the flowering period, only a rough calculation can be made at this time. As stated above, the farmers claim that a grove of this bamboo which goes into the flowering condition will regain its former vegetative vigor more quickly than a newly set grove will reach mature size. Thus, the flowering period of a given clump must be, in all, somewhat less than ten years in length. On the other hand, plants secured while in the height of their flowering condition have, after three years of flowering under observation, only now begun to recover their vegetative vigor. Thus, it seems probable that the flowering period of Tea Stick Bamboo is somewhere between five and ten years in length, perhaps six or seven years. No information has yet been forthcoming on the date of any former epidemics of flowering in the groves of this bamboo, or on the probable length of the cycle.

Harvesting the Culms

On good soil a new grove may produce some culms of marketable size within four or five years. As a matter of fact, the *maturity* of the individual culm is of more importance than its *size* in this connection. Culms are usually harvested when they are at least two and not more than four years old. The age of a living culm of this bamboo is glaringly apparent to anyone familiar with the changes which it undergoes as time passes. A culm in the first year of its growth will have fresh, green, more or less immature foliage, and the branches will be somewhat tender. Culm sheaths sometimes remain attached at the nodes. First year stems retain the characteristic sharp, brittle, appressed hairs which are visible only upon closest scrutiny but are readily perceptible to a slight touch of the hand. Furthermore, first year stems are free from any growth of lichens or the black, smutty fungus both of which discolor them characteristically as time goes on. By the following year the culm sheaths are all lost, some of the old leaves may die and fall off, new branchlets are produced and bear new leaves, which combination gives a ready index to the fact that the culm is not of the current year's growth. In succeeding years the growth of lichens and surface fungi afford an unfailing sign, to the initiated, of the age of the culm. Another clue is available to one who has watched the recent development of the grove in which the observations are carried on—the relative size of the culms of different ages. Normally, during the early years of the development of a grove, the culms of each successive year will be larger in diameter and loftier in stature. On the other hand, in the case of prolonged drought or reversion to the flowering condition, the culms produced in each

successive year will be progressively smaller in diameter and shorter in stature. Either of the tendencies, then, affords a further help in telling the respective ages of adjacent culms.

Harvesting is done, apparently, throughout the year. The culms are severed just below the surface of the ground by means of a strong, oblique blow with a heavy, sharp knife. The branches are removed on the spot and the culms tied in bundles of convenient size for carrying. These bundles are then transported on the backs of men to the bank of the nearest stream of sufficient size to float a raft. Here the culms are sorted roughly according to size and again tied into bundles (fig. 6). These bundles are then made into rafts of varying size and floated down stream to the scouring beach (fig. 7.)

Scouring the Culms

Here they are taken ashore and each culm is scoured with wet sand (figs. 8 and 9). Women and children share largely in this operation; men to a limited extent. This work is paid for by the piece. Following the scouring operation the bamboos are tied into bundles of standard numbers of culms, this time being bound only about the middle. The ends are now spread so that the bundles resembles huge hour glasses in shape, which enables them to stand alone (figs. 7 and 10) they are then put in the sun to dry and bleach. At night and during rain they are placed under shelter. The drying and bleaching process takes a number of days—usually a week is sufficient in good weather.

When the culms have been thoroughly cured they are carefully sorted into size groups, according to orders which have been forwarded from the export agent, sawed to the desired lengths and tied in bundles of standard sizes. These bundles (fig. 13) are transported by cargo boat down the Sui River (綏河) to Fatshan, where the Chinese export dealers in this bamboo are all located.⁶

Export Dealers

There are, in Fatshan, six native firms engaged solely in the business of preparing the stems of this bamboo for export. They export some of their wares directly, but most of the business passes through the hands of export agents of various nationalities, established in Canton, on Shameen and in Hongkong.

The functions of the two types of firm, however, are very different. The foreign firms act merely as agents and handle only the prepared stems, whereas the Chinese firms mentioned above have extensive plants and perform certain very important operations in the final preparation of the culms for the consumer.

⁶ This bamboo is exported to the United States, England, France, Germany, Sweden and other Western countries.

Preparing the Culms for Export

Entering one of these institutions one finds himself presently in a large, lofty storeroom filled with high stacks of bundles of Tea Stick Bamboo of all sizes. In the rear is a sunning yard along one side of which extends a long, narrow, low building containing a series of firepots. In this building, over these firepots, a most interesting operation is performed, namely, the straightening of the culms. While Tea Stick Bamboo is outstandingly the straightest of the bamboos of southern China, most of the culms have one or more small crooks which, though not obvious to the untrained eye of a casual observer, must be removed in order to meet the strict requirements of the foreign market. The general outline of the procedure by means of which this is done is as follows.

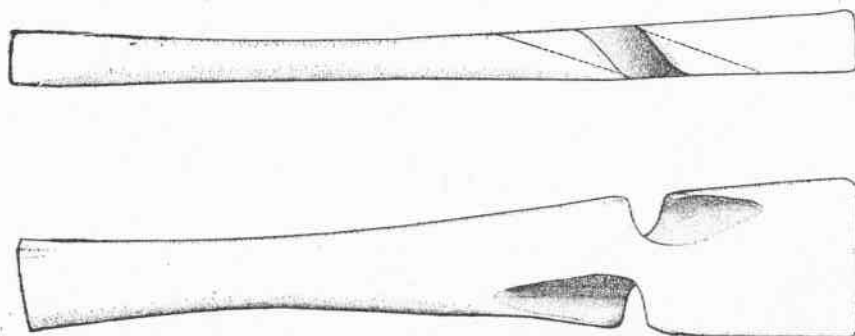


Fig. A. Wooden tool by means of which the smaller bamboo culms are straightened after heating ($\times \frac{1}{2}$).

Each worker has a thick-walled earthenware firepot, without a chimney, in which a kind of smokeless coal⁷ is burned, a very hot bluish flame playing above the incandescent coals. Two large bricks are laid across the top of the firepot with a space of about 1½ inches between them, through which most of the flames pass. The bamboos to be straightened are stacked for a time, in their original bundles, on the racks which are about a foot above the firepots. Thus they are gradually warmed up. The worker sits on a low stool before his firepot from which position he can reach and pull down the bamboos from the rack without rising. The culms are thrust, one at a time, into the glowing channel between the two bricks, kept there in motion for the brief space of two or three seconds, then withdrawn and subjected to a vigorous straightening process by means of a

⁷ This coal has the appearance and hardness of the bituminous form but it may be an unusually soft form of anthracite. It brings a slightly higher price than the ordinary bituminous form sold in Canton.

wooden tool (see sketch, fig. A). The various crooks in each bamboo are straightened separately, the heatings and bendings following each other in quick succession.

In straightening the larger culms, some of which are more than two inches in diameter, a little different technique is used to get the necessary leverage, but the fundamental process is the same. They have to be held rigidly in the desired position until the tissues are cool in order to have the effect of the straightening become permanent.⁸ From the straightening room the bamboos are taken to the warehouse where they are sorted, cut to desired lengths and packed for shipment.

Substitutes for this Bamboo

There are a number of other, smaller bamboos occurring wild in this region which, though inferior in most respects to the true Tea Stick Bamboo, share its characteristics to a sufficient degree to enable them to be substituted for it to a certain extent. These have no doubt been used locally for a long time and in recent years, probably as a result of the curtailment of the production of the latter due to the epidemic of flowering referred to above, there seems to be a tendency to substitute certain of them for the Tea Stick Bamboo in the foreign trade. Thus far the following bamboos of the genus *Arundinaria* which might by the casual observer be confused with the smaller sizes of Tea Stick Bamboo, have come to our attention:

NAME	SOURCE
Man Lei Chuk (文理竹).....	Yung Hui, Kwangsi
Lei Kaang Chuk (離間竹).....	Ch'eung P'eng Shi, Loh Kong Tung, P'oon Ue District, Kwangtung
Foo Chuk (苦竹).....	Kwangtung Province (widely distributed)
Paak Chuk (白竹).....	Hoh Uen District, Kwangtung
Pat Chuk (筆竹).....	Honam Island, near Canton, Kwangtung

⁸ This is essentially the same technique as that used in straightening green bamboo stems and in warping the semi-cured stems in the making of bamboo furniture. The physics of this process has not been explained, so far as the writer is aware. The following is his own idea of its possible nature. The pectic compounds which cement plant cells together are soluble in hot water. Although the culms are comparatively dry after repeated sunnings, perhaps the water present in the pectic layer is sufficient, when heated, to cause a softening of this material which makes possible the slight adjustment between the tissues necessary in the straightening process. When the tissues cool, the pectic layer would then harden again and hold the tissues rigidly in their new relation.

All these but the last find their way to Fatshan, and thence are distributed to local users. The last two are scoured with sand and bleached in the sun in the same manner as Tea Stick Bamboo. Pat Chuk, which is softer and weaker than Tea Stick Bamboo, is apparently used exclusively in the making of Chinese writing brushes. Paak Chuk is a very thick-walled, stiff variety which compares very favorably in strength and durability with the smaller sizes of Tea Stick Bamboo, and the substitution of this variety for the latter involves no unfair deception.

Insect Problem

One of the most serious problems which any dealer in bamboo has to face is that of the destructive action of certain minute beetles which bore into, weaken and eventually destroy the culms if they are not disturbed. One of the incidental effects of the heating involved in the straightening process is that of destroying any of these beetles or their eggs which may be in or on the culms. This treatment is said to make the culms immune, for a considerable period, from the attacks of these beetles. It is not considered a permanent protection, however. Sunning is also a moderate deterrent against the attacks of these beetles, and when any very long time has to elapse between the receipt of the culms from the country and their treatment with fire in the straightening process, regular sunning is used as a precautionary measure.

Acknowledgment

The writer wishes to acknowledge here his indebtedness to the China Foundation for the Promotion of Education and Culture for a grant of money which made possible the continuation and completion, to the point where publication seemed justifiable, of the work on this bamboo. The form first came to his attention in 1925, at which time it was recognized to be a very interesting and distinct species. By 1928 sufficient work had been done to assure the writer that the species was, in all probability, an undescribed one, but no really good flowering specimens had been found, and one hesitated to publish on the basis of the inadequate material in hand. In the same year a sum of money was granted to Lingnan University by the China Foundation for the Promotion of Education and Culture, for the purpose of financing special survey projects in Entomology and Botany. A portion of this grant was set aside for the bamboo work already well under way, but inadequately financed. This grant, which became available in 1929, made possible several very fruitful field trips, among them being a third trip to the haunts of the Tea Stick Bamboo which resulted in the securing of a fine series of flowering specimens for study and for distribution. These are now ready to be distributed to the leading botanical centers in China and abroad.

[EXPLANATION OF PLATES*

PLATE 34

- Fig. 1. Young plant of Tea Stick Bamboo, Ch'a Kon Chuk (茶桿竹) *Arundinaria amabilis* McClure, in a newly set out grove. Note cuttings of cassava in the background (see text, p. 297).
 Fig. 2. Newly planted grove of Tea Stick Bamboo on a very steep hillside.
 Fig. 3. A clump of Tea Stick Bamboo in the Lingnan University Bamboo Garden (Introduction No. 1830) planted in March, 1929. This clump produced no new shoots in the spring of 1930 but the rhizome underground had been growing, and in the spring of 1931 it sent up 30 shoots, some of which exceed a meter in height (see text, p. 298).

PLATE 35

- Fig. 4. Established groves of Tea Stick Bamboo bordering on a public road.
 Fig. 5. Tea Stick Bamboo is to be classed as one of China's most handsome bamboos. A frame formed by its tall, straight culms and elegant foliage enhances greatly one's view of distant scenes.
 Fig. 6. Bundles of freshly cut culms of Tea Stick Bamboo being made into a raft to be floated down to the scouring beach.

PLATE 36

- Fig. 7. View of a scouring beach scene. Note: raft of bundles of unscoured bamboos in the foreground; women and children at work along the bank of sand at the water's edge, scouring the culms; hour-glass shaped bundles of scoured culms sunning on the beach; storage yard and shelters on high bank in background (see text, p. 301).
 Fig. 8. Nearer view of the work of scouring the culms. Note: heaps of sand, and the fan-like screens of bamboo branches set up to shade the workers.

PLATE 37

- Fig. 9. Close-up of the scouring operation, showing method.
 Fig. 10. Each worker stacks his day's work together in the storage yard at night.

PLATE 38

- Fig. 11. Stack of the tips of the larger culms of Tea Stick Bamboo. These are not exported but are used locally. Note bark-thatched hut whose walls are woven of these tips.
 Fig. 12. Enclosures fenced with terminal portions of the culms of Tea Stick Bamboo. The two fences are woven in different patterns.

PLATE 39

- Fig. 13. Cargo boat being loaded at Au Tsai with bundles of Tea Stick Bamboo for shipment to Fatshan. The beach is crowded with stacks of the scoured and bleached stems.
 Fig. 14. Au Tsai, a tiny river-side market town, remote from modern life, nestles amongst bamboo-clad hills at the center of distribution of Tea Stick Bamboo.

* All of the photographs used here were taken by the author. With the exception of Figure 3, they were taken in the vicinity of Au Tsai, District of Wai Tsaap, Kwangsi.



