

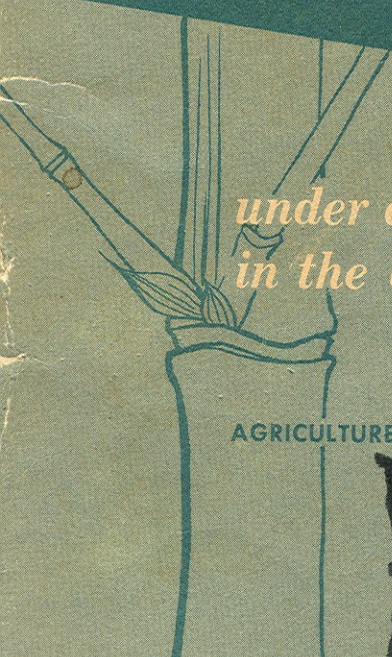
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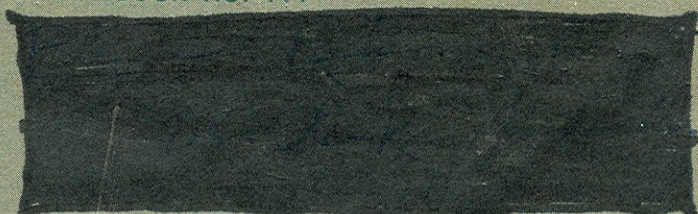
# BAMBOOS

OF THE GENUS PHYLLOSTACHYS

*under cultivation  
in the United States*



AGRICULTURE HANDBOOK NO. 114



U. S. DEPARTMENT OF AGRICULTURE

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By F. A. McClure, Botanist  
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Excepting figures 1 and 28, the line drawings were all made by the author. To keep them all as closely comparable as possible, each culm sheath illustrated was taken from about the middle of a representative culm.

# BAMBOOS OF THE GENUS *PHYLLOSTACHYS* *under cultivation* *in the United States*

By F. A. McCLURE, botanist, Crops Research Division, Agricultural Research Service

This Handbook provides a key for the field identification, without flowers or fruits, of the 34 bamboos of the genus *Phyllostachys* (24 species and 10 horticultural forms, herein designated as cultivars (cv.)) that have been successfully introduced into the United States. Another cultivar was

added after the key was completed. These bamboos are all native to China. A description of each entity, based on the living plant, is provided for the user's convenience in checking the identifications he makes by means of the key.

## ECONOMIC IMPORTANCE OF BAMBOO

In China and Japan, and in other parts of the Far East, an astonishing number of objects and materials of common daily use are fabricated entirely or in part from bamboo (8, 10).<sup>1</sup> Indeed, bamboo occupies such an important place in the human economy of some regions, particularly in south-eastern Asia and adjacent islands, that large sectors of the population would be destitute without it. In vast areas, bamboo is the one material that is sufficiently cheap, and adequate in supply, to fill the tremendous need for economical housing (9).

On account of their obvious potential value to agriculture and industry, and their appeal as exotic garden ornamentals (12), the bamboos, particularly those belonging to the genus *Phyllostachys*, have been the focus of absorbing interest in the United States for many years. Although a number of successful importations of living plants had been achieved by private initiative during the late eighteen hundreds, the activities of the United States Department of Agriculture in the introduction of promising bamboos began about 1900. The first bamboo appeared in the Department's "Inven-

tory of Plants Introduced" in 1899 under the P. I. No. 2903.<sup>2</sup> Since that time some 750 individual bamboo introductions have appeared in the records. Of these, about 200 represent species of *Phyllostachys*.

The center of distribution of this group of bamboos is in China, to which country nearly all of the known species are native.

In China bamboos of the genus *Phyllostachys* have been for centuries the principal source of paper pulp, a major source of timber and handicraft materials, and an important source of that esteemed comestible, bamboo shoots. In Japan bamboos of this genus have supplied valuable items of export in the form of fishing poles and porch shades, commodities familiar everywhere in this country. Also a large array of materials, including paper pulp, is important in the local domestic trade. This is the more impressive when it is realized that, of this numerous group of bamboos, Japan has in general cultivation only four species and their variants. In the United States 24 species and 11 culti-

<sup>1</sup> Italic numbers in parentheses refer to Literature Cited, p. 67.

<sup>2</sup> P. I. refers to accession number of the Plant Introduction Section as published in the series of Plant Inventories of the Department.

vars of *Phyllostachys* are now established, principally through the activities of agricultural explorers of the United States Department of Agriculture.

Plants of a number of these species have been distributed for trial in various parts of the United States. A partial perspective on their future

place on the farm and in the land-use patterns has been achieved, but the task of exploring the potentialities of this group of plants in the economy of the United States, especially for paper pulp and for use in watershed protection and erosion control, remains largely untouched.

### GROWTH HABIT OF BAMBOO

In a developing bamboo plant or grove, the oldest culms are the smallest. This paradox is caused by two characteristics of the growth habit. First, the bamboo culm emerges from the ground with the diameter that it will always have, and it attains its full height in a few short weeks. It never increases in diameter or height after the few weeks of growing, though it may remain alive for many years. Second, the new culms produced each successive year emerge from the ground with a greater diameter and reach a greater height before they stop growing, because the plant has extended its underground system of rhizomes and

roots during the intervening period. This expansion increases the capacity of the plant for drawing water and raw materials from the soil and enables it to store a greater amount of food. The new culms produced each year are nourished during their development principally by this stored food (fig. 1).

Like most bamboos, those in the genus *Phyllostachys* are evergreen. However, they change their leaves completely every year. This occurs in the spring, the old ones falling away as the new ones develop. The process is gradual and inconspicuous and usually attracts attention only through the appearance of a new carpet of gold



FIGURE 1.—A representative portion of a plant of *Phyllostachys viridis* (*P. mitis* A. & C. Riv.), showing the horizontal indeterminate underground stem (rhizome) bearing leafy aerial stems (culms) and young shoots. The direction of growth of the rhizome is right to left. (Adapted from A. & C. Riviere, *Les Bambous*.)

and brown beneath the plant. The leaf blades are cut off from their sheathing bases by a natural process of abscission, resulting from the formation of a layer of corklike cells at the base of the leafstalk. Replacements are produced in advance of the fall of these leaves, but on new twigs developed from lower buds of the old ones. The old twigs, released by abscission, fall away in their turn, so that congestion is avoided or greatly reduced.

### VEGETATIVE CHARACTERISTICS OF THE GENUS PHYLLOSTACHYS

Clump (individual plant) typically thicketlike, actively spreading with an open (sometimes more or less crowded) arrangement of the culms; rhizomes indeterminate (advancing indefinitely underground), slender, with short, grooved internodes and more or less swollen nodes, every node (except several at the very base of each branch rhizome) bearing a bud and a row of roots that emerge from the ridge above the sheath scar; culms erect or suberect, never climbing, arising from buds on the rhizome, more or less distantly spaced (since some of the buds remain dormant); internodes of the culm usually hollow, cylindrical or nearly so above the lower nodes when these have no buds, but marked by a groove extending from the point of origin of each bud or branch complement as far as the next node, usually showing a more or less copiously farinose (white powdery) zone just below the sheath scar at each node; the nodes (at least the branch- or bud-bearing ones) usually marked by a distinct ridge encircling the culm just above the sheath scar; culm sheaths promptly deciduous; branch buds usually present at all of the nodes in small culms, especially in young plants, lacking at the lower nodes of culms in mature plants, but always present at all of the upper nodes, one to several of the lowermost usually remaining dormant, the rest developing very promptly; branches often solitary at one or two nodes in the lower part of

The shape and dimensions of leaf blades vary according to the position of each on the twig, the lower ones being shorter and broader, the upper ones progressively longer and narrower. The leaf blades are edged with a cartilaginous border that is densely set with sharp-pointed antrorse spinules along one margin (the one that is outermost when the leaf is still rolled up in the bud) and more sparsely so or entirely smooth on the other margin.

the series, otherwise typically two at each node, the two usually more or less strongly unequal, with a third very much smaller, sometimes developing between the two (atypically and rarely, in exceptional culms, the branches clearly ternate, with the strongest one in the middle as occasionally observed in *P. nigra* and its forms); leaf blades lanceolate to linear lanceolate, with tessellate venation (transverse veinlets clearly visible, at least on the lower surface) usually glabrous on the upper surface and usually distinctly paler, often definitely glaucous on the lower surface, with a patch of more or less persistent silky antrorse hairs usually visible on each side of the midrib at the base.

The following combination of vegetative characters distinguishes bamboos of the genus *Phyllostachys* from those of all other genera: Rhizomes slender, wide-ranging, indeterminate, bearing buds at all nodes beyond the basal "neck" region; culm internodes each roughly D-shaped in cross section throughout its length when it stands above a node bearing a fully developed branch complement, roughly circular in cross section above a node without a bud or branch complement; culm branches typically two at each node (the two usually more or less strongly unequal in size) with a third, usually much smaller, sometimes developing between the two (from the first node of one of them) (fig. 2); leaf blades with typical tessellate venation, i. e.,

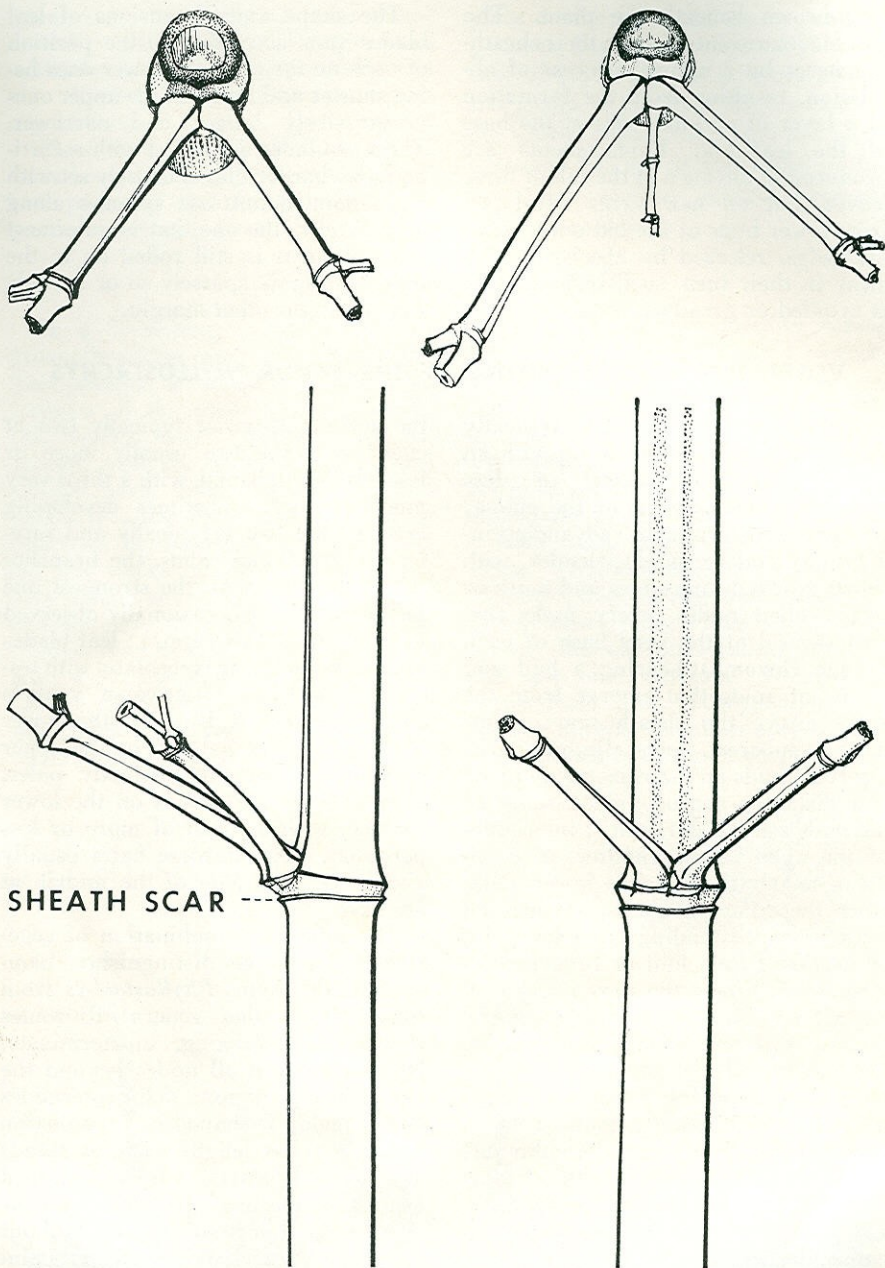


FIGURE 2.—A midculm node and adjacent portion of a culm of *Phyllostachys elegans* typifies the genus in the following respects: The branch-bearing nodes are marked by a prominent ridge (sometimes referred to as a pulvinus) above the sheath scar; the internodes of the culm are flattened by grooves above the point of insertion of each branch complement and the branches are borne typically in 2's at each node, but sometimes a third branch develops between the other two. (Based on a specimen from P. I. No. 128778.)

with transverse veinlets, clearly visible, especially in transmitted light, forming

small right-angled quadrangles with the longitudinal veins or nerves.

### INTRODUCTION TO THE KEY

As the number of kinds of bamboo established in the United States has grown, the problem of identifying them and distinguishing them from each other has become more critical. Bamboos present special difficulties in this respect, because they so rarely bear flowers, which are the traditional basis for identification. Since the determination of the identity of a bamboo for practical purposes cannot wait on the appearance of flowers, it has been necessary to use other means to this end. The characters employed in the following key and in the descriptions of the individual kinds, therefore, are based wholly on vegetative structures and no reference has been made to flowers.

This key is designed solely for the identification in the field of relatively mature living plants during spring, when the young shoots are actively growing. It cannot be relied upon to identify small or immature plants whose distinctive characteristics have not as yet fully revealed themselves. It will not be found useful in the field at other times of the year than spring, except for those bamboos whose culms show distinctive structure or coloration, or characteristic pubescence. It may, of course, be used in the herbarium to identify plants about which the necessary information has been recorded or is revealed by preserved specimens.

The characteristics most generally useful in the identification of bamboo species (once the genus is known) are found in the culm sheaths that clothe the young shoot. These characteristics reveal themselves most vividly while the sheaths are in the fresh state. As they dry, their delicate, often very distinctive colors fade to light or dark straw, though any spots of dark pigment usually persist. The tissues shrink and sometimes become more or

less warped, and some of the delicate parts, such as the auricles and the ligule, become brittle and easily broken when dry.

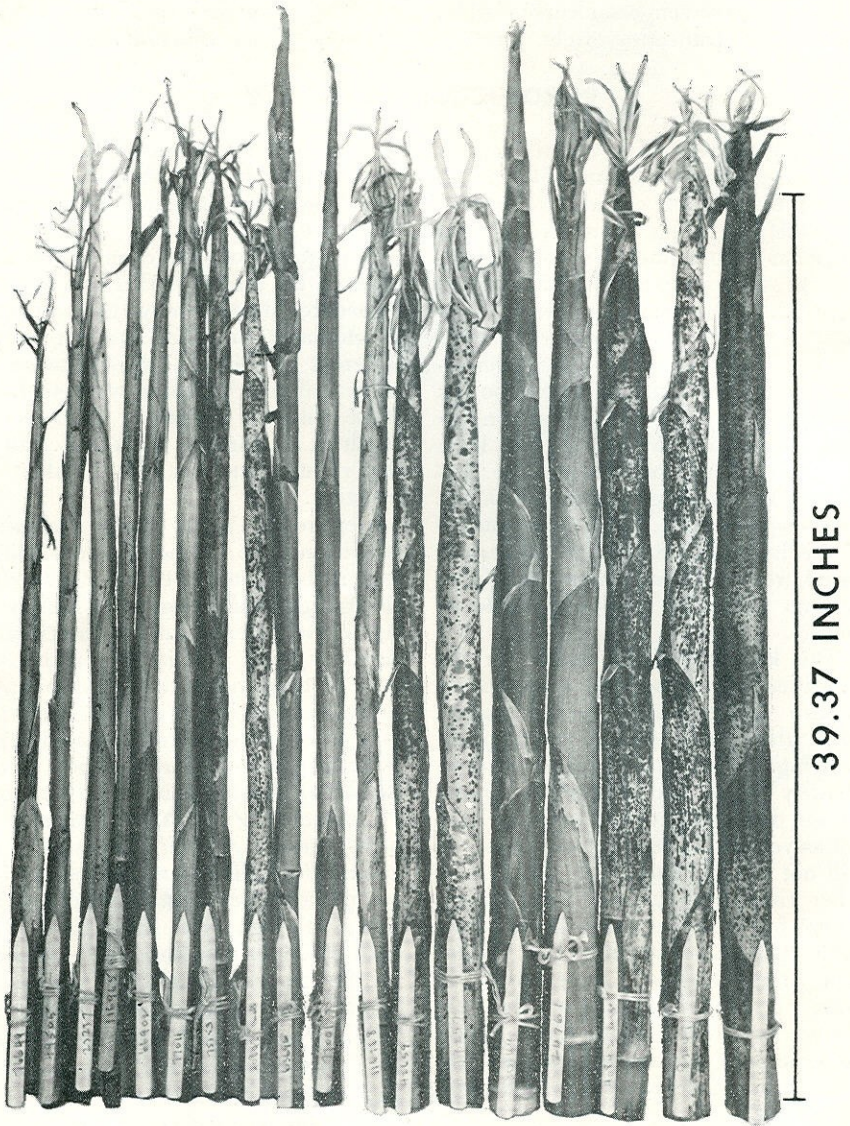
It is quite possible, even likely, that some of the bamboos this key was designed to identify may, upon further development or when growing under different conditions, show characteristics different in some respects from those hitherto revealed. This could result in a failure of the key to lead to the right name for the bamboo in question.

Depending upon local ecological conditions, the period of shoot initiation in bamboos of the genus *Phyllostachys* generally begins in March or April and extends until some time in April or May. Variations in the pattern of temperature and precipitation prevailing during this critical period may cause more or less marked fluctuations in the onset and duration of the period of shoot initiation. *P. arcana*, *P. bissetii*, *P. dulcis*, *P. elegans*, *P. nuda*, and *P. viridi-glaucescens* are among the earliest, and the others follow in a sequence that is fairly consistent though not invariable. The earliest species may have all their shoots of the current year fully grown in height with their culm sheaths all fallen away before the latest kinds, *P. bambusoides* and *P. viridis*, have started to send up their shoots (fig. 3).

In cases where a slight variation in the expression of an obscure character might otherwise cause the user to arrive at a wrong name for his plant, a given bamboo may appear in the key more than once.

The following key and descriptions are based on living plants growing at the United States Barbour Lathrop Plant Introduction Garden at Savannah, Ga., hereinafter referred to as the Garden.





P. I. S. NEG. 89735

FIGURE 3.—Young shoots of 17 bamboos of the genus *Phyllostachys* assembled for comparison. The scale is a meter. Left to right: *P. propinqua* (P. I. No. 76649); *P. nigra* (P. I. No. 49505); *P. angusta* (P. I. No. 23237); *P. flexuosa* (P. I. No. 116965); *P. rubromarginata* (P. I. No. 66902); *P. glauca* (P. I. 77011); *P. aurea* (P. I. No. 75153); *P. bambusoides* (P. I. No. 40842, small shoot); *P. nidularia* (P. I. No. 63696); *P. purpurata* cv. Straightstem (P. I. No. 77001); *P. meyeri* (P. I. No. 116768); *P. bambusoides* cv. Castillon (P. I. No. 42659); *P. viridis* (P. I. No. 77257); *P. congesta* (P. I. No. 80149); *P. nigra* cv. Henon (P. I. No. 24761); *P. bambusoides* (P. I. No. 40842); *P. vivax* (P. I. No. 82047); *P. pubescens* (P. I. No. 80034).

## KEY FOR FIELD IDENTIFICATION

(For Use in Spring Only)

- 1a. Culms showing distinctive persistent color markings at sheath-fall or within the first year.
- 2a. Internodes of culms showing yellow or yellowish-green ground color at sheath-fall.
- 3a. Ground color of culm internodes bright yellow; a few leaves showing cream stripes.
- 4a. Internodes showing the groove as a broad, green panel; additional green stripes of varying width appearing outside the groove.  
*P. bambusoides* cv. CASTILLON.
- 4b. Internodes yellow, the groove not green, but very rarely a lower internode in an occasional culm showing a thin green stripe.  
*P. bambusoides* cv. ALLGOLD.
- 3b. Ground color of culm internodes sulfur-green, with a broken band of darker green below each node at sheath-fall, and an occasional, more or less persistent dark-green stripe on lower internodes; nodal ridge obsolete (hardly visible) in unbranched nodes; internodes showing characteristic pigskinlike surface under  $9\times$  lens, or to a sensitive touch. . . . . *P. viridis* cv. ROBERT YOUNG.
- 2b. Internodes of culms showing green ground color at sheath-fall.
- 5a. Internodes of the culm gradually becoming speckled or spotted with rusty brown, sooty, or brownish or purplish black.
- 6a. Culms becoming speckled then mottled, and eventually (within 1 to 3 years) more or less completely covered with brownish or purplish-black spots. . . . . *P. nigra* (typical form).
- 6b. Culms becoming sparsely to densely strewn, principally on the lower internodes, with rusty-brown or sooty spots.
- 7a. Nodal ridge obsolete at unbranched nodes; culms rarely erect; spots on internodes rusty brown and very small at first, developing first where full sunlight strikes the culm.<sup>1</sup>
- 8a. Culm internodes velvety pubescent at sheath-fall; the sheaths very hairy on the back. . . . . *P. pubescens*.
- 8b. Culm internodes and sheaths without hairs at sheath-fall.  
*P. viridis* (typical form).
- 7b. Nodal ridge more or less prominent at unbranched nodes; culms usually erect or nearly so.
- 9a. Culm sheaths without spots, the blade broadly to narrowly triangular, trough-shaped, wavy, the spots on the culms few, large, irregularly shaped, sooty to rusty brown. . . . . *P. nigra* cv. BORY.
- 9b. Culm sheaths spotted, the blade strap-shaped, not trough-shaped.
- 10a. Auricles present; sheath blades crinkled; spots on internodes rusty brown and very small, developing first where full sunlight strikes the culms.  
*P. elegans*.
- 10b. Auricles not present; sheath blades not crinkled.
- 11a. Ligule truncate, fringed with red bristles; spots on internodes mostly circular or roundish, sooty, developing without respect to direct sunlight, appearing principally just above the lower nodes soon after sheath-fall.  
*P. makinoi*.
- 11b. Ligule convex, not fringed with red bristles; spots on internodes irregular in shape, black, developing only under relatively intense illumination, not aggregated in relation to the nodes. . . . . *P. arcana*.

<sup>1</sup> Not to be confused with the type of spotting that characterizes *P. nigra* and its cultivar BORY, though some culms of juvenile plants of *P. viridis* show apparently that type of spotting.

- 5b. Internodes of the culm not becoming speckled or spotted.
- 12a. Culm internodes showing at sheath-fall a somewhat obscure but distinctive yellow-green or greenish-yellow color on the groove; surface of internode scabrous to touch (under  $9\times$  lens strewn with minute, stiff white hairs), the internodes not distinctly ribbed, culms erect but an occasional one having one more or less strongly geniculate node, making a definite angle between adjacent internodes usually near the ground (sometimes several feet up); young shoots not strongly phototropic. . . . . *P. aureosulcata*.
- 12b. Culm internodes not showing a distinctive yellow green or greenish yellow on the groove, but those in lower part of some culms showing vertical stripes of cream or pale green;<sup>2</sup> surface of internodes glabrous, smooth to touch.
- 13a. Internodes noticeably to strongly ribbed-striate, lower ones in some culms showing cream or pale-green stripes (striped culms bearing some cream-striped leaves); culms rarely erect, usually more or less curved, the young shoots strongly phototropic. . . . . *P. dulcis*.
- 13b. Internodes not noticeably ribbed-striate, lower ones in culms 1 inch or more in diameter may show cream pin stripes; culms usually erect or nearly so except at edges of the grove, the young shoots mildly phototropic. . . . . *P. angusta*.
- 1b. Culms green or, in some species, showing at sheath-fall a more or less marked temporary suffusion of wine at and below the nodes.
- 14a. Culm sheaths marked by dots or stipples or round spots of sooty or sometimes brownish hue, few, small, and widely scattered to many, large, and contiguous or overlapping.
- 15a. Auricles normally present on sheaths of culms of mature stature; culm sheaths glabrous or pubescent on the back.
- 16a. Nodal ridge obsolete (hardly visible) at unbranched nodes; culms rarely erect, young shoots strongly phototropic.
- 17a. Culm internodes velvety pubescent at sheath-fall; the culm sheaths very hairy on the back. . . . . *P. pubescens*.
- 17b. Culm internodes and sheaths without hairs. . . . . *P. viridis* (typical form).
- 16b. Nodal ridge more or less prominent at unbranched nodes; culm internodes without hairs.
- 18a. Culm internodes noticeably to strongly ribbed-striate, relatively short, usually more or less conspicuously coated with white powder; culm sheaths often showing a few inconspicuous hairs on the back; sheath blades strongly crinkled; ligules strongly convex at the apex.
- 19a. Ligule of culm sheaths strongly decurrent, not conspicuously fringed with hairs on the margin; ground color of culm sheaths very pale; shoots strongly phototropic. . . . . *P. dulcis*.
- 19b. Ligule of culm sheaths not strongly decurrent, conspicuously fringed with hairs on the margin; ground color of culm sheaths more or less tawny; the culms not strongly curved; shoots not strongly phototropic. . . . . *P. elegans*.
- 18b. Culm internodes not noticeably ribbed-striate; the sheaths often sparsely hairy on the back.
- 20a. Internodes and culm sheaths showing more or less abundant, rather loose, floccose white powder at sheath-fall; the sheaths gradually tapered toward the narrow apex; the ligule usually very tall. . . . . *P. viridi-glaucescens*.
- 20b. Internodes and culm sheaths showing no white powder at sheath-fall; the sheaths rather broadly rounded toward the blunt apex; the ligule not very tall.
- 21a. Culms not normally showing marked deviations in the direction of growth. *P. bambusoides* (typical form).
- 21b. Culms showing a high incidence of marked sinuous deviation of the order of an inch or more in the course of their growth, usually within 1 to 3 feet of the base.

<sup>2</sup> Dark-green stripes occur occasionally on the lower internodes of *P. flexuosa*, *P. glauca*, and *P. viridi-glaucescens*, but so rarely and so inconspicuously (usually a single stripe on a single internode) that this weak character is not used in this key.

- 22a. Culms often more slender (internodes often more elongate in proportion to diameter than in the typical form of *P. bambusoides*) and not becoming conspicuously white in age. *P. bambusoides* cv. SLENDER CROOKSTEM.
- 22b. Culms showing about the same proportions as those of the typical form of *P. bambusoides* and becoming conspicuously white with a waxlike covering in age.  
*P. bambusoides* cv. WHITE CROOKSTEM.
- 15b. Auricles normally lacking on culm sheaths (rudiments do not appear); sheath blades strap-shaped, more or less strongly spreading away from the culm, not trough-shaped, culm sheath without hairs on the back.
- 23a. Ligule of culm sheaths weakly developed in height (not exerted), the margin (except in the lower sheaths) usually fringed with coarse, pale-green bristles; some culms in every clump showing one to several strongly shortened (abortive) often more or less ventricose internodes; sheath scars and the basal edge of the culm sheaths fringed with minute white hairs. . . . . *P. aurea*.
- 23b. Ligule of culm sheaths more strongly developed in relative height (more or less noticeably exerted); culms not showing shortened (abortive) internodes as in *P. aurea*.
- 24a. Culm internodes strongly ribbed-striate, noticeably shrunken immediately below the sheath scar in culms from plants of mature stature; culms perceptibly (but usually inconspicuously) sinuous from asymmetrical development of the internodes; shoots not at all phototropic, the culms strictly upright, even at the edge of the clump, very white with waxlike coating in age. . . . . *P. vivax*.
- 24b. Culm internodes not strongly ribbed-striate, not shrunken immediately below the sheath scar.
- 25a. Ligule apex typically convex.
- 26a. Sheath scars and basal edge of culm sheaths fringed with minute white hairs; ligule apex with a hump in the middle. . . . . *P. meyeri*.
- 26b. Sheath scars and basal edge of culm sheaths not fringed with hairs.
- 27a. Culm sheath ligule relatively short, not at all decurrent, with a hump in the middle of the rounded apex; internodes of the culm showing very inconspicuous deposit of white powder at sheath-fall; culm sheaths always smooth to touch, the veins not strongly salient in fresh ones. . . . . *P. propinqua*.
- 27b. Culm sheath ligule relatively tall, strongly decurrent, convex at the apex; internodes of the culm showing conspicuous deposit of loose white powder at sheath-fall; culm sheaths often scabrous to touch, the veins strongly salient in the fresh ones. . . . . *P. arcana*.
- 25b. Ligule apex typically truncate (convex in an occasional sheath in *P. angusta*).
- 23a. Surface of culm internodes showing pigskin effect, especially just below unbranched nodes; ligule of culm sheaths prominently fringed with bristles, these red when fresh. . . . . *P. makinoi*.
- 23b. Surface of culm internodes not showing pigskin effect; ligule of culm sheaths not fringed with red bristles.
- 29a. Internodes and culm sheaths almost or entirely without white powder at sheath-fall; culm sheaths very pale, striate with cream and pale lavender when fresh, the ligule tall, prominently fringed with pale bristles.  
*P. angusta*.
- 29b. Internodes and culm sheaths showing a more or less conspicuous deposit of white powder at sheath-fall; culm sheaths without color striation.

30a. Powder on culm internodes and sheaths loose, more or less floccose; veins strongly salient in fresh culm sheaths; the lower sheaths often scabrous to touch and stained with irregular dark areas, the sheaths very sparsely strewn with small, well-defined sooty dots.

*P. nuda.*

30b. Powder on culm internodes and sheaths evenly distributed, not loose or floccose; veins only moderately salient in fresh culm sheaths, the sheaths never scabrous to touch, the lower sheaths strongly spotted, not showing irregular purple stains as in *P. nuda*; the sheaths when fresh showing a green-and-buff ground color suffused with rose or wine, along the veins.

31a. Culm internodes completely and evenly covered with a conspicuous layer of white powder imparting a distinctive blue-green or glaucous overall color to the culms at sheath-fall; the sheath blade relatively short and broad, suddenly narrowed (abruptly acute) at the apex; the ligule deeply tinted with wine. . . . *P. glauca.*

31b. Culm internodes incompletely covered (upper half only) with a thin layer of white powder at sheath-fall, the sheath blade narrower and more narrowly acute at the apex; the ligule not deeply tinted with wine.

*P. flexuosa.*

14b. Culm sheaths not at all marked by dots or stipples or spots.

32a. Culm internodes without hairs or nearly so.

33a. Auricles lacking entirely on culm sheaths; ligule very short.

34a. Sheath blade narrowly triangular to strap-shaped, not wavy, not closely appressed to the culm; the ligule straight or slightly concave at the apex (not strongly concave in upper culm sheaths), the margin fringed with minute white hairs and backed by coarse, dark-red bristles originating on the adaxial surface (these often lost on drying); lower culm sheaths edged with red at the apex when fresh; internodes very rarely (in large culms only) showing a few, widely scattered, scarcely perceptible hairs; the green color of the culm almost completely obscured in age by a white, waxlike deposit; culms gently tapered, somewhat willowy.

*P. rubromarginata.*

34b. Sheath blade broadly to narrowly triangular and trough-shaped above, wavy, closely appressed to the culm; the ligule straight to slightly convex at the apex (very strongly concave in upper culm sheaths), the margin fringed with minute white hairs only; the lower sheaths not edged with red at the apex when fresh; internodes (excepting the lowest 2 or 3) entirely without hairs; the culms thick at the base and rather strongly tapered, stiffly upright. . . . . *P. congesta.*

33b. Auricles normally present on culm sheaths (often very rudimentary in *P. purpurata* and its forms, and normally obsolescent or lacking entirely in *P. congesta*).

35a. Culm sheath auricles very small; sheath blade triangular, strongly trough-shaped, more or less wavy, appressed to the culm; the sheath never striped with white.

36a. Culms noticeably thicker at the base, rather strongly tapered and stiffly upright. . . . . *P. congesta.*

- 36b. Culms not noticeably thicker at the base, very gently tapered, often relatively weak and more or less willowy.
- 37a. Internodes hollow throughout the culm.
  - 38a. Culms strongly zigzag throughout.
    - P. purpurata* (typical form).
  - 38b. Culms strongly zigzag only in the branched part. . . . . *P. purpurata* cv. STRAIGHTSTEM.
- 37b. Internodes not hollow in the lower one-third to two-thirds of the culm. . . *P. purpurata* cv. SOLIDSTEM.
- 35b. Culm sheath auricles large, clasping the culm; the sheaths at lower nodes of the culm more or less conspicuously striped with white and green and sometimes suffused with wine.
- 39a. Culm sheaths and the sheath scars shaggy hirsute with retrorse brown hairs. . . . . *P. nidularia* (typical form).
- 39b. Culm sheaths and the sheath scars entirely without hairs.
  - P. nidularia* cv. SMOOTHSHEATH.
- 32b. Culm internodes usually (except in very small culms) more or less thickly to thinly strewn with small, erect white hairs perceptible to touch.
- 40a. Culm sheaths hairy, ruddy buff throughout; the sheath scar fringed with brown hairs at sheath-fall; the sheath blade broadly to narrowly triangular, trough-shaped, wavy, appressed to the culm; auricles prominently developed, fringed with numerous bristles. . . . . *P. nigra* cv. HENON.
- 40b. Culm sheaths without hairs, or in very vigorous large culms the lower sheaths sometimes somewhat hairy, the sheath scar glabrous.
- 41a. Sheath blade lance-shaped to strap-shaped, more or less strongly spreading away from the culm; ligule of culm sheaths truncate (straight or only slightly convex at the apex), short but well exerted at the sides of the base of the sheath blade; the auricles long and falcate (obsolete on some sheaths) with few bristles; the lower culm sheaths often striped with greenish cream or white on the back and edged with red at the apex when fresh. . . . . *P. decora*.
- 41b. Sheath blade narrowly triangular.
- 42a. Culm sheath blade appressed to the culm (not spreading or reflexed); auricles weakly developed (sometimes nearly obsolete), dark red, attached to the base of the blade; oral setae sometimes strongly developed and erect, not spreading; lower culm sheaths not striped with white, and not edged with red at the apex when fresh.
- 43a. Internodes hollow throughout the culm.
  - 44a. Culms strongly zigzag throughout.
    - P. purpurata* (typical form).
  - 44b. Culms strongly zigzag only in the branched part. . . . . *P. purpurata* cv. STRAIGHTSTEM.
- 43b. Internodes not hollow in the lower one-third to two-thirds of the culm. . . *P. purpurata* cv. SOLIDSTEM.
- 42b. Culm sheath blade spreading away from the culm, rarely more or less reflexed.
- 45a. Lower sheaths more or less distinctly striped with white and lavender (showing residual striping when dry); auricles typically ovate to broadly falcate; apex of ligule strongly convex; pubescence of internodes dense, retrorse, readily perceptible to touch; culms frequently showing one or more strongly geniculate nodes near the base.
  - P. aureosulcata*.
- 45b. Lower sheaths not striped with white (sometimes faintly striped with wine, but not showing residual striping when dry); auricles typically narrow, falcate (or ovate), obsolete on some sheaths; apex of ligule weakly convex; pubescence on internodes very sparse, barely perceptible on lower internodes only; culms rarely showing strongly geniculate nodes. . . . . *P. bissetii*.

DESCRIPTIONS OF SPECIES AND CULTIVARS

*Phyllostachys angusta* McClure,  
Wash. Acad. Sci. Jour. 35: 278.  
1945.

(Figs. 4 and 5.)

Culms up to 21 ft. 8 in. tall and  $1\frac{5}{16}$  in. in diameter at the base, fairly straight, erect or nearly so except where exposed during growth to more light on one side; internodes (No. 1 (at base): 3 in. long; No. 5: 7 in. long; No. 11—the longest in a culm 21 ft. 8 in. long, with 47 internodes— $10\frac{3}{8}$  in. long) green or very rarely with a few cream pin stripes on the lower internodes of large culms, grayish in age, entirely glabrous, very weakly glaucous at sheath-fall, especially just

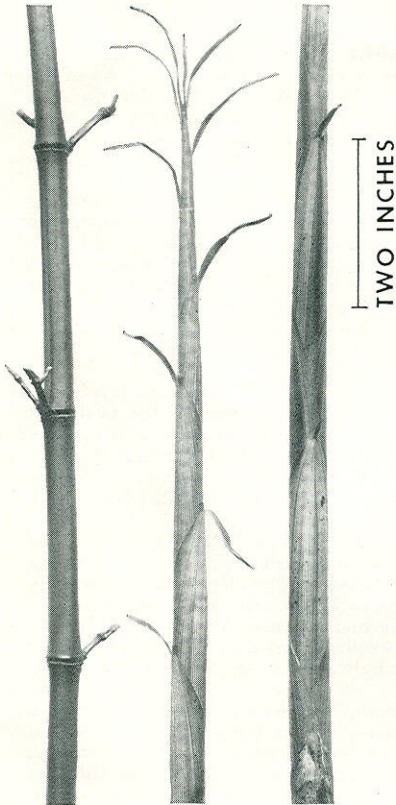


FIGURE 4.—*Phyllostachys angusta* (P. I. No. 23237): Culm and young shoots from near Kensington, Md.

P. I. S. NEG. 37370

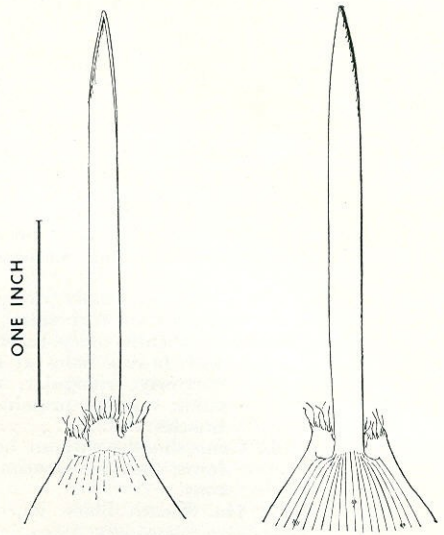


FIGURE 5.—*Phyllostachys angusta* (P. I. No. 23237: Inner (left) and outer (right) aspects of the apex of the culm sheath, showing sheath blade and fringed ligule.

below the nodes, usually not noticeably ribbed-striate; nodal ridges scarcely more prominent than the sheath scars; sheath scars glabrous,<sup>3</sup> thin, only moderately flared; culm sheaths very pale in color, often appearing almost white at a distance, the ground color cream (turning to pale beige on drying), the veins outlined in pale lavender (vertical banding in cream, lavender, and sometimes pale green, often occurs), sparsely strewn with small brown dots, entirely glabrous throughout on the back, not perceptibly glaucous but lustrous and waxy to the touch when fresh; auricles and oral setae lacking; ligules tall, narrow, only very rarely somewhat decurrent, pale greenish yellow, the apex truncate to somewhat convex, the margin more or less strongly toothed or lacinate, prominently fringed with

<sup>3</sup>A row of microscopic white hairs (invisible to the naked eye) marks the base of the sheath while it is still attached, but these are usually not to be found, either on the base of the sheath or on the sheath scar after sheath-fall.

pale bristles; sheath blades narrow, lance-shaped to strap-shaped, spreading away from the culm, not crinkled, the upper ones long and recurved, all pale green, sometimes more or less perceptibly suffused with lavender, with a wide cream border; leaf sheaths rarely show auricles or oral setae; ligules well developed, exserted; leaf blades glabrous or glabrescent except at the base on the lower surface, up to  $6\frac{3}{16} \times \frac{3}{4}$  in., more commonly  $4\frac{1}{2}$  in. long and up to  $1\frac{1}{16}$  in. wide.

From the similarity in the shape and proportions of the culm sheaths, this bamboo is perhaps most likely to be confused with *P. flexuosa*. However, the culm sheath in *P. angusta* is color striped and is paler and less prominently maculate than the culm sheath in *P. flexuosa*. The ligule of the culm sheath in *P. angusta* is longer and fringed on the margin with more prominent bristles than the same structure in *P. flexuosa*. The culm internodes in *P. flexuosa* are glaucous in the upper half at sheath-fall, at which time the powder is barely noticeable on the culm internodes in *P. angusta*.

This bamboo was originally obtained at Tang-si, Chekiang Province, China, in 1907, by Frank N. Meyer, agricultural explorer of the United States Department of Agriculture. It is growing at the Garden under P. I. No. 23237. In a plant 19 years old, culms of maximum height (21 ft. 8 in.) had the first branches 13 ft. 2 in. above ground. According to Meyer the Chinese name "Sah Chu" (Stone Bamboo) alludes to the hard texture of the culms, which are "mostly used in the manufacture of fine bamboo furniture, it being a very strong kind." The shoots are edible, and are singularly free from the acidity, or "bite," that mars the flavor of some species. Shoot initiation begins at midseason.

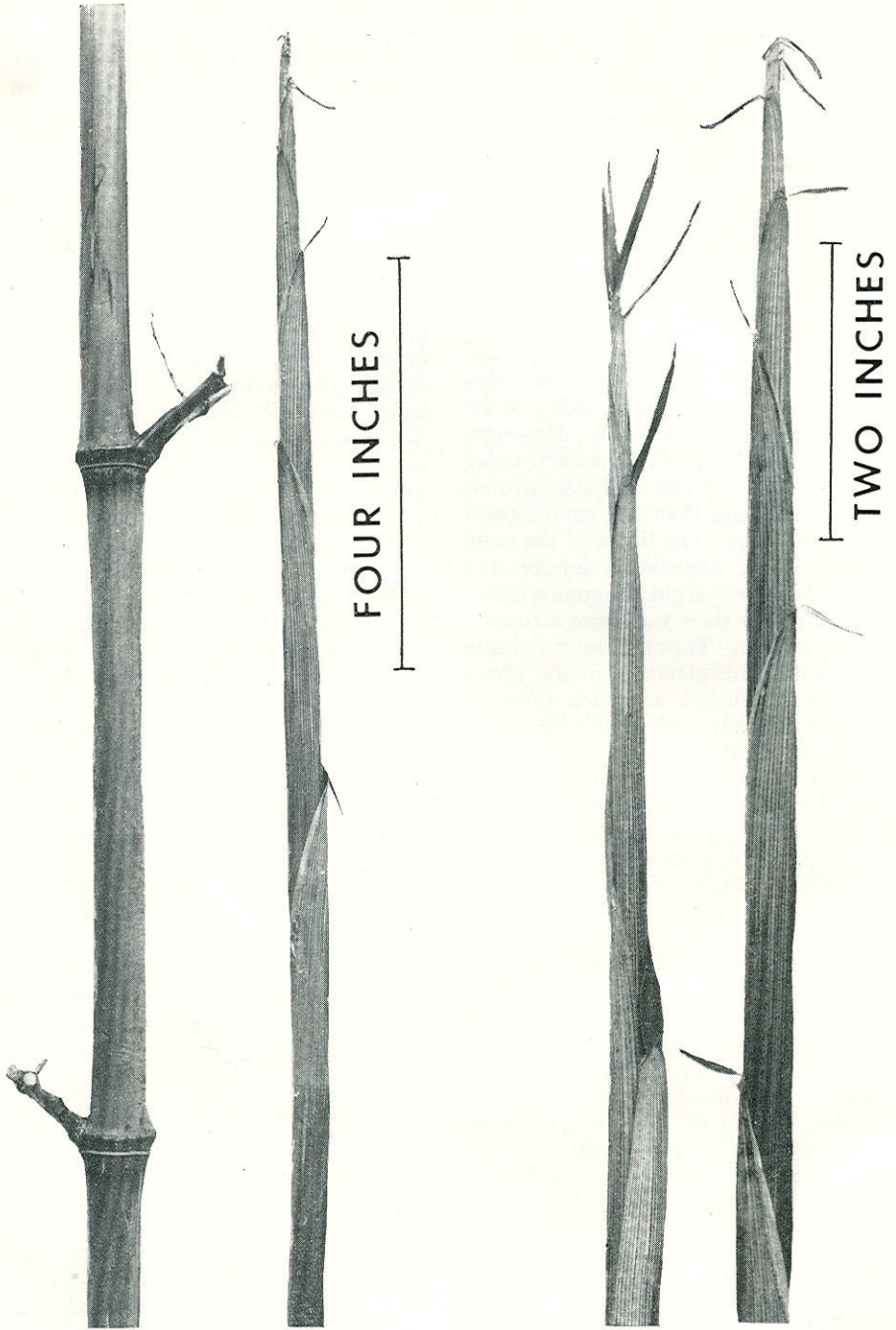
Culms of this bamboo were included in studies on seasoning and physical properties carried out by H. E. Glenn and others at Clemson Agricultural College, South Carolina (3).

The plant has proved to be hardy at Washington, D. C. The distribution of this bamboo is still extremely limited; it apparently has not been listed by any nursery as yet.

**Phyllostachys arcana** McClure,  
Wash. Acad. Sci. Jour. 35: 280.  
1945. (Figs. 6 and 7.)

Culms up to 27 ft. 3 in. tall and  $1\frac{5}{16}$  in. in diameter at the base, usually more or less sinuous, sometimes strongly curved near the base, otherwise erect or nearly so, except where exposed during growth to more light on one side; internodes (No. 1:  $3\frac{1}{8}$  in. long; No. 5:  $8\frac{5}{8}$  in. long; No. 14—the longest in a culm 27 ft. 3 in. long, with 54 internodes— $13\frac{7}{8}$  in. long) green, with abundant, loose, floccose powder unevenly distributed at sheath-fall, entirely glabrous, usually perceptibly ribbed; nodal ridges rather prominent, narrow; sheath scars glabrous, thick, rather abruptly and somewhat strongly flared; culm sheaths grayish or lavender beige with the salient green veins outlined in lavender, the basal ones bearing here and there a blotch of purple (later brown), sparsely maculate with small brownish-purple dots, usually noticeably glaucous at first, scabrous to subglabrous, the upper ones usually immaculate and glabrous; auricles and oral setae not developed; ligules prominently developed, strongly convex at the apex, fringed with tiny hairs or smooth along the undulate margin, very fragile and soon more or less broken, usually strongly decurrent; especially in the sheaths at lower and median levels; sheath blades narrow, lance-shaped to strap-shaped, spreading or more or less strongly bent back, often more or less wavy, but not crinkled; leaf sheaths usually without auricles and oral setae; ligules prominently exserted, rounded at the apex, very delicate and soon broken; leaf blades usually glabrous or nearly so, even at the base, on the lower surface (sometimes setulose on the lower sur-





P. I. S. NEGS. 37359, 37364

FIGURE 6.—*Phyllostachys arcana* (P. I. No. 77007) : Culm and young shoots from the Garden.

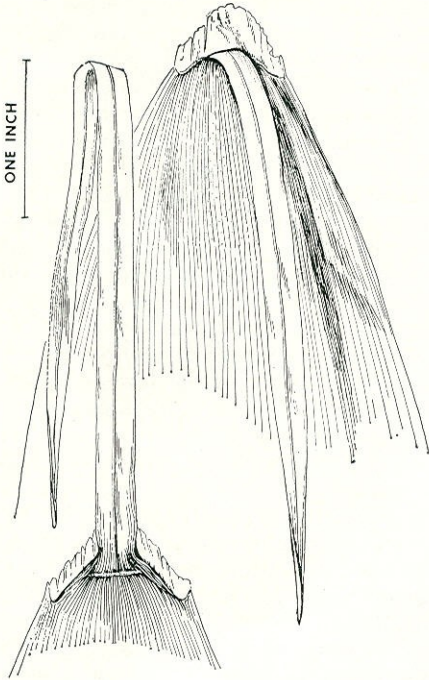


FIGURE 7.—*Phyllostachys arcana* (P. I. No. 77007): Apex of culm sheath, showing sheath blade and ligule.

face in old culms), up to  $6\frac{1}{8} \times \frac{3}{4}$  in., more commonly  $4 \times \frac{5}{8}$  in. or smaller.

From *P. nuda* McClure, which it resembles closely in some respects, *P. arcana* is readily distinguished by the tall, strongly arched ligule of the lower culm sheaths and by the peculiar way in which the dormant buds at the lower culm nodes become partially covered by the extension of the nodal ridges.

This bamboo was originally introduced into this country from China in 1926 under P. I. No. 77007 by the writer as agricultural explorer for the United States Department of Agriculture. Propagating material under the name "Lao Chu" was obtained at Pessz-kung Monastery, Chiu-hwa-shan, Anhwei Province, where it was observed both in the wild and in cultivation.

The name "arcana" means hidden. It was chosen on account of the initial difficulty experienced in finding outstanding recognition characters for this bamboo. It likewise describes a peculiar condition of the dormant buds at the base of the culm.

Internodes throughout the culms may with age gradually develop irregular black spots, numerous in proportion to the degree of exposure to direct sunlight—these being most conspicuous on the south side of culms at or near the south edge of the clump.

In a plant 28 years old, culms 26 ft. 5 in. tall had the first bud at the 5th to the 9th node above ground, and the first branch complement at the 22d to the 27th node.

Shoot initiation begins early in the season. The shoots are eaten in China, and the withes split from culms are used by the Chinese in weaving matting and for making lanterns.

Culms of this bamboo were included in studies on seasoning and physical properties carried out at Clemson Agricultural College, South Carolina (3).

Cultivation of this species has not been undertaken in any part of the United States outside the Garden. It apparently is not listed by any nursery.

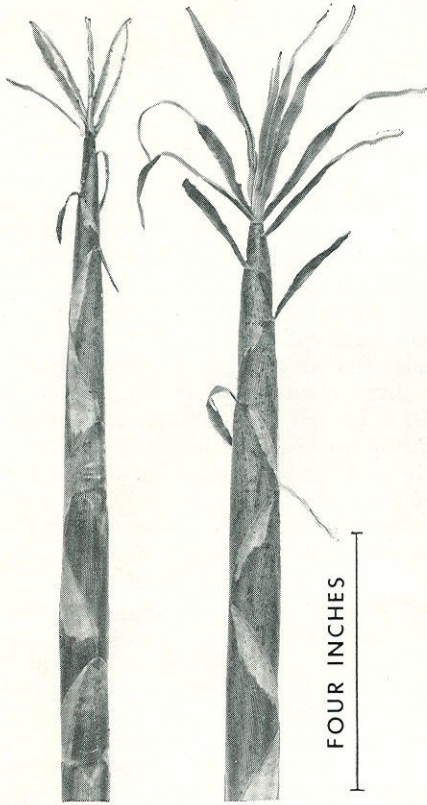
***Phyllostachys aurea*** A. & C. Riv.,  
Soc. Acclim. B. Ser. 3, 5: 716.  
1878.

Fishpole Bamboo; Hotei-Chiku  
(Japanese). (Figs. 8 and 9.)

*P. bambusoides* var. *aurea* (Riv.)  
Makino, Bot. Mag. Tokyo 11:  
158. 1897.

Culms up to 27 ft. 3 in. tall and about  $1\frac{5}{8}$  in. in diameter at the base, very straight and stiffly erect, the habit not affected by exposure during growth to more light on one side; internodes<sup>4</sup>

<sup>4</sup>In a variable but usually high percentage of the culms and at any position on the lower half of the culm, but most commonly at the very base, one to several internodes are very much shortened and more or less asymmetrically inflated (fig. 9).



P. I. S. NEG. 37339

FIGURE 8.—*Phyllostachys aurea* (P. I. No. 38919): Young shoots from the Garden.

(No. 1:  $2\frac{3}{8}$  in. long; No. 5:  $5\frac{5}{16}$  in. long; No. 16—the longest in a culm 27 ft. 3 in. long, with 56 internodes— $10\frac{1}{4}$  in. long) green, visibly to strongly glaucous soon after sheath-fall, gray in age, smooth (not striate), entirely glabrous from the first; nodal ridges only moderately prominent; sheath scars rather thin, not strongly flared, about as prominent as the nodal ridges, fringed with short white hairs that persist for some time after sheath-fall; culm sheaths pale olive green to pale rosy buff, with wine or pale-green veins, rather sparsely strewn with small brown spots, not glaucous, bearing minute white hairs in a narrow zone (a line) along the base, otherwise entirely

glabrous; auricles and oral setae lacking; ligules very short, the apex slightly convex or rarely slightly concave and ciliate on the margin in the lower several sheaths, slightly taller and long-ciliate to fimbriate on the margin in mid-culm sheaths; sheath blades lance-shaped and more or less crinkled below, becoming long, narrowly strap-shaped and pendulous above; leaf sheaths with auricles and oral setae well developed or often lacking entirely; ligules very short, scarcely exerted; leaf blades glabrous or glabrescent except at the base of the lower surface, up to  $6\frac{9}{16} \times \frac{7}{8}$  in., more commonly 4 to  $4\frac{3}{4} \times \frac{3}{4}$  in.

From *P. meyeri* McClure, which it resembles closely in many respects, *P. aurea* is readily distinguished by the much shorter, smoothly convex ligule of the culm sheath, and by the prominent fringe on the margin of ligules on the upper sheaths. *P. propinqua*, also closely related to *P. aurea*, lacks the fringe of hairs on the culm sheath scars and has a narrower culm sheath blade and a hump in the middle of the longer culm sheath ligule.

*P. aurea*, native to China, long established in cultivation in Japan, Europe, and South America, was successfully introduced into this country in 1914 by the United States Department of Agriculture. Plants from the Centro Agricola at Bahia, Brazil, were obtained through the courtesy of V. A. Argolla Ferrão. Some of these plants are established in the bamboo collection at the Garden under P. I. No. 38919. This species is further represented at the Garden by P. I. No. 55975 from L'Hermitage, Mons, Belgium, which was obtained as seeds from Jean Houzeau de Lehaie, and by P. I. No. 75153, obtained as plants from the Royal Botanic Garden, Kew, England. Earlier successful introductions of this species were made by private individuals. One of these introductions is represented by a 10-acre planting at Montgomery, Ala., dating back to 1883.

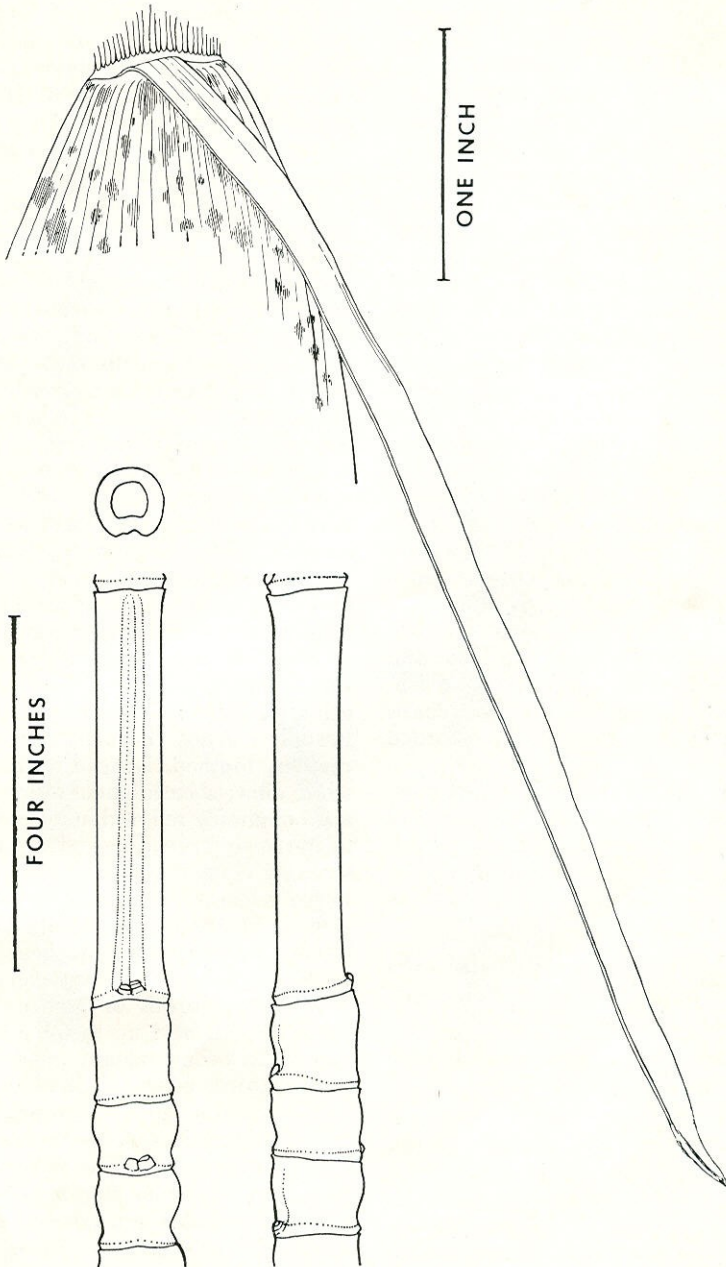


FIGURE 9.—*Phyllostachys aurea* (P. I. No. 75153): Apex of culm sheath, showing sheath blade and fringed ligule; (below) base of culm, showing shortening of internodes manifested by a certain proportion of the culms in every clump.

In a 30-year-old plant at the Garden a culm 27 ft. 3 in. tall had its first bud at the 15th node (7 ft. 9 in. above-ground) and the first branches at the 20th node (about 13 ft. aboveground).

The culms are stiff and generally relatively straight. The wood is unusually hard and bonelike when thoroughly matured and dried. In China and Japan culms selected for size and perfection are used for fishing poles, walking sticks, umbrella handles, fan handles, and pipe stems. Culms of this bamboo have for years been imported from Japan in considerable quantities for use in the natural state as fishing poles. The shoots are very palatable, being relatively free from acidity, or "bite," even in the raw state (13). Shoot initiation begins at midseason.

*P. aurea* is one of the most widely cultivated of the bamboos of the genus *Phyllostachys* established in this country. It is found on the Pacific coast as far north as British Columbia, and it is cultivated as far north as Washington, D. C., on the Atlantic coast. Its temperature tolerance is recorded as  $-4^{\circ}$  F.<sup>5</sup>

Culms of this bamboo were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

At least 10 nurseries have listed this species (11).

***Phyllostachys aureosulcata*** McClure, Wash. Acad. Sci. Jour. 35: 282. 1945.

Yellowgroove; Stake and Forage bamboo.

(Figs. 10 and 11.)

Culms up to 26 ft. 6 in. tall and  $1\frac{3}{8}$  in. in diameter at the base, erect or nearly so, more or less flexuose<sup>6</sup> to nearly straight, the habit affected little or not at all by exposure of growing

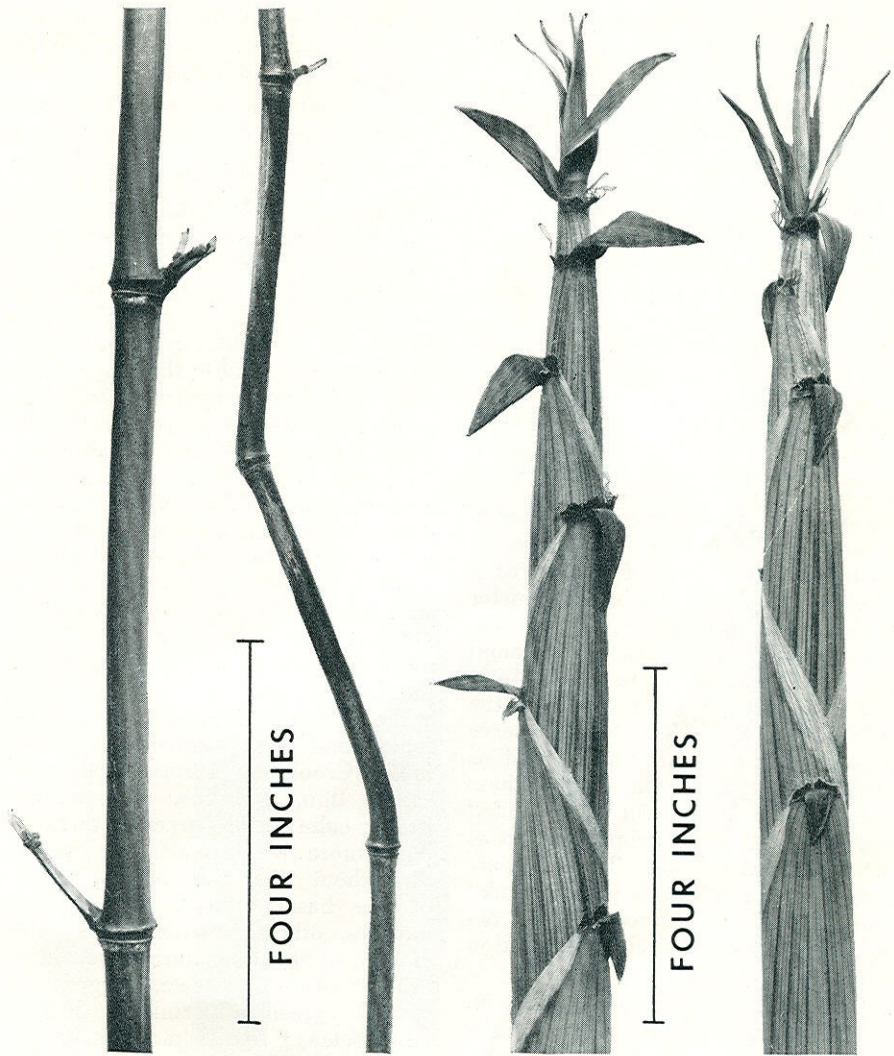
shoots to more light from one side; internodes (No. 1:  $\frac{3}{8}$  in. long; No. 2:  $5\frac{3}{8}$  in. long; No. 16—the longest in a culm 22 ft. 5 in. long, with 49 internodes— $10\frac{3}{8}$  in. long) dull green, with a green-and-yellow striped panel above the insertion of buds and branches (also in an analogous position above unbranched nodes), lightly and loosely powdery, especially just below the nodes at sheath-fall, scabrous to touch at first, usually not noticeably ribbed-striate; nodal ridges moderately prominent, narrow; sheath scars abruptly flared, almost as prominent as the nodal ridge, clean cut, glabrous; culm sheaths pale olive with pale-green and often pale-wine and cream streaks, never spotted, glabrous on the back, noticeably to conspicuously coated with loose somewhat floccose powder when fresh; auricles lacking in the lowermost several sheaths and in those above the middle of the culm, elsewhere usually well developed, rather broad, ovate, rather sparsely fringed with delicate, crinkly bristles; ligules well developed, broadly convex, the margin rather irregular, toothed, fringed with minute white cilia; sheath blades lance-shaped and commonly reflexed in lower sheaths to narrowly spreading, triangular, not strongly elongate, sometimes wavy, in upper sheaths; leaf sheaths with auricles and oral setae usually lacking; ligules weakly exerted; leaf blades weakly puberulent at the very base, otherwise glabrous or glabrescent on the lower surface, up to  $6\frac{3}{16}$  in. long and  $\frac{3}{4}$  in. broad, usually much shorter and narrower, especially in older culms.

The specific epithet alludes to the distinctive coloration of the sulcus of young culms and their branches. After a person becomes familiar with *P. aureosulcata* it is not likely to be confused with any other bamboo. Field characters that are easily recognized: White-striped culm sheaths; internodes of young culms scabrous to touch and showing a greenish-yellow panel on the groove.

*P. aureosulcata* was obtained at

<sup>5</sup> Data from files of Plant Introduction Section.

<sup>6</sup> A character of the species is the occasional occurrence of one to several strongly geniculate nodes, usually within the first 3 feet aboveground.



P. I. S. NEGS. 37355, 37351

FIGURE 10.—*Phyllostachys aureosulcata* (P. I. No. 55173): Left, small culm; center, culm showing characteristic zigzag growth occasionally manifested; right, young shoots. All from the Garden.

Tang-si, Chekiang Province, China, by Frank N. Meyer in 1907, and plants of it are growing at the Garden under P. I. No. 55713. Plants distributed to collaborators about 1925 as the "Stake and Forage Bamboo" were of this species, identified at that time as *P. nevini*.

Next to *P. aurea* and *P. bambusoides*,

*P. aureosulcata* is one of the most widely distributed species of the genus in cultivation in the United States, owing to the emphasis on its distribution that was in effect during the twenties. Records of the Department of Agriculture give its geographical range in cultivation as "Gulf to the Carolinas; Pacific coast," and its temperature tol-

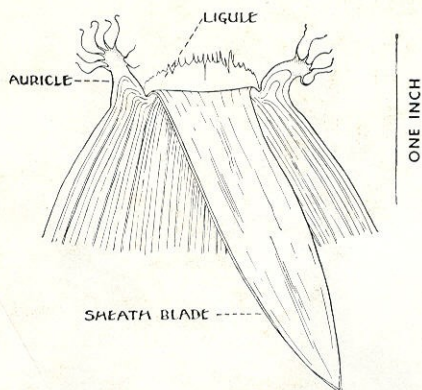


FIGURE 11.—*Phyllostachys aureosulcata* (P. I. No. 55713): Apex of culm sheath, showing sheath blade, ligule, and auricles.

erance as 0° F. It is commonly seen around Washington, D. C., where, in favorable situations, the culms reach a height of 30 ft. and a basal diameter of an inch or a little more. It is one of five species whose shoots were found by R. A. Young (13) to be "entirely free from any unpleasant taste in the uncooked state." The culms serve satisfactorily as fishing poles and as garden stakes; it is primarily for these purposes that it is grown in the United States, though many people value it as an ornamental as well. The relatively high incidence of culms with a "kink" near the base would reduce their acceptability in commercial competition with other bamboos.

A culm 23 ft. 10 in. tall and 1¼ in. in diameter at the base, taken from the midst of a colony about 30 years old, had its first bud at node 16 (7 ft. 9 in. aboveground) and its first branches at node 23 (13 ft. 8 in. aboveground).

Shoot initiation begins in early mid-season.

Culms of *P. aureosulcata* were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

At least three nurseries have listed this species (11).

***Phyllostachys bambusoides* Sieb. & Zucc., Kgl. Bayer. Akad. Wiss. Abh. 3: 746. 1843.**

Giant Timber bamboo; Madake (Japanese).<sup>7</sup> (Figs. 12 and 13.)

*P. reticulata* of Japanese botanists.

Culms up to 72 ft. tall and 5¾ in. in diameter at the base, erect or nearly so, except in the margin of a dense grove where they lean toward the most intense light, relatively straight, or in some of the horticultural forms strongly sinuous near the base; internodes (No. 1: 4 in. long; No. 5: 9⅝ in. long; No. 22—the longest in a culm 48 ft. long, with 60 internodes—16¾ in. long) green, or in several horticultural forms golden yellow or golden yellow with a variable amount of green striping, glabrous throughout, lustrous, without any sign of white powder at sheath-fall, usually not noticeably striate; nodal ridges variable, slightly more to slightly less prominent than the sheath scars in the typical form of the species and in the yellow-stemmed forms, and often scarcely discernible in the "Crookstem" forms; sheath scars rather thin, glabrous, not strongly flared; culm sheaths greenish to ruddy buff, more or less densely spotted throughout with dark brown, several of the basal ones usually without auricles, others bearing usually two (rarely one), these narrow to rather broadly ovate or falcate, fringed with several greenish crinkled bristles (oral setae); ligules moderately well developed, the apex more or less strongly convex with the margin ciliate in smaller culms to nearly straight and fringed on the margin with coarse bristles in larger ones; sheath blades short, lance-shaped, reflexed, and crinkled in lower sheaths to long, strap-

<sup>7</sup> Common names of the typical form. The species name, standing alone, designates the typical form of the plant. The description however, is drawn up so as to include the scope of variation represented by the cultivars. Deviations from the typical form are designated by reference to the cultivar names.



P. I. S. NEG. 78535

FIGURE 12.—*Phyllostachys bambusoides*, the typical form (P. I. No. 77003): Young shoots from the Garden.



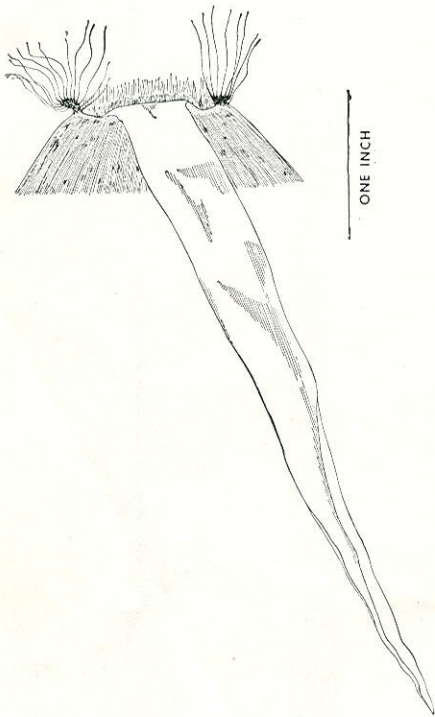


FIGURE 13.—*Phyllostachys bambusoides*, the typical form (P. I. No. 40842): Apex of culm sheath, showing sheath blade, ligules, and auricles.

shaped and recurved in upper ones, green or beautifully colored with pastel shades: Green down the middle, with an equally wide band of blended wine, green, and buff on each side, and a narrow margin of cream; leaf sheaths usually with auricles and oral setae well developed; ligules well developed; leaf blades up to  $7\frac{1}{2} \times 1\frac{1}{4}$  in., with  $1\frac{5}{8} \times \frac{1}{2}$  in. to  $6\frac{7}{8} \times 1$  in. a common range, puberulous to subglabrous except at the base on the lower surface.

The typical form of *P. bambusoides* is perhaps most apt to be confused with *P. vivax*, which differs in the broader apex of the culm sheaths and their complete lack of auricles, the more pendulous habit of the leafy twigs, and the slightly asymmetrical shape of the internodes in the unbranched part of the culm. The typical form of *P. bambusoides* is also apt to be confused with

the typical form of *P. viridis*, which differs in the complete lack of auricles and oral setae on the culm sheaths, in the broad farinose zone below the culm nodes, and the pigskinlike surface of the culm internodes.

The Giant Timber bamboo, native to China and cultivated in Japan for a very long time, has been introduced repeatedly and has been planted perhaps more widely in this country than any other bamboo; at least 11 nurseries have listed it (11). The earliest introductions, made by private individuals, are generally not well documented. Even the history of the introduction of the plants (P. I. No. 40842) that produced the now famous grove of this bamboo at the Garden is incomplete. David Fairchild (1) says it was introduced by Andreas E. Moynelo "probably in the late eighties," and planted on the present site in 1890. The precise origin of the material is in doubt.

*P. bambusoides* is represented at the Garden by other introductions as follows: P. I. Nos. 12180, 77003, 118926, and 128787.

In a culm 48 ft. 2 in. tall,  $2\frac{7}{8}$  in. in diameter, with 60 internodes, taken from the midst of a grove, the first bud occurred at node 24 (25 ft. 4 in. above the ground) and the first branches developed at node 28 (30 ft. 4 in. above the ground).

Shoot initiation begins relatively late.

The typical form of this species is the one most cultivated in China and Japan for its useful culms, and, indeed, it may be said to be the most versatile bamboo of the genus *Phyllostachys*. Because of this versatility, the large size reached by the culms under favorable conditions, and the prolific production of edible shoots having only a slight degree of acidity even in the raw state (13), *P. bambusoides* has been favored by the United States Department of Agriculture and by farmers as the one most likely to make a place for itself in the rural economy. Its only serious competitor in both size

and vigor is *P. vivax*, whose culms are not so straight and for this reason less generally useful. Recently developed industries for the preservation of bamboo culms for the market and for the fabrication of an impressive array of specialties depend principally on the domestic supply of *P. bambusoides*. Its minimum temperature tolerance is estimated as 0° F.<sup>8</sup> It is hardy at Glenn Dale, Md., and a few clumps are known to be thriving in Washington, D. C.

Culms of this bamboo were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

During World War II, culms of *P. bambusoides* were subjected to comparative tests along with 11 other species, representing 4 distinct genera, as material for making laminated (hexagonal) ski poles. The following is quoted from the report on these tests (6): "In workability, this species probably excels all of the species tested under this project, with the exception of Tonkin Cane [*Arundinaria amabilis*]. Unfortunately [*P. bambusoides*] . . . fell slightly below the minimal requirements of Test No. 3 [span] in average performance. Furthermore . . . unimpregnated shafts . . . 'take a set' regularly when subjected to moderate but firm lateral stress."

Four distinct horticultural forms of this species are cultivated at the Garden.

Eight nurseries offered plants of *P. bambusoides* in 1955.

**Phyllostachys bambusoides** Sieb. & Zucc. cv. ALLGOLD McClure, Arnold Arboretum Jour. 37: 193. 1956.

*Phyllostachys sulphurea* A. & C. Riv., Soc. Acclim. B. Ser. 3, 5: 773. 1878.

*P. castillonii* var. *holochrysa* Pfitz., Deut. Dendr. Gesell. Mit. 14: 60. 1905.

*P. quilioi* var. *castillonii holochrysa* Regel ex H. de Leh., Bambou, p. 118. 1906.

*P. bambusoides* var. *castillonii holochrysa* (Pfitz.) H. de Leh., Congr. Internatl. de Bot. 3, Actes 2: 228. 1912.

*P. reticulata* var. *sulphurea* Makino, Bot. Mag. Tokyo 26: 24. 1912.

*P. bambusoides* var. *sulphurea* Makino ex Tsuboi, Illus. Jap. Sp. Bamb., ed. 2, p. 7, pl. 5. 1916.

*P. reticulata* var. *holochrysa* (Pfitz.) Nakai, Jour. Jap. Bot. 9: 34. 1933.

Allgold bamboo is distinguished from the typical form of the species by the overall color of its culms and branches—bright yellow at sheath-fall (sometimes diffused with dilute wine, especially in the lower part of the culm), turning at length to a rich golden yellow. In an occasional culm a lower internode shows a thin, vertical stripe of green. An occasional leaf blade shows a white or cream stripe. In ultimate culm size Allgold is considerably smaller than the typical form of the species, but does not differ from the type in any strictly morphological character.

Allgold differs from the Castillon bamboo (from which it is said by Japanese botanists to have originated) in lacking the green panel on the sulcus of culm and branch internodes and in having the green striping occur rarely, often lacking entirely.

Nakai writes, "This is of Chinese origin. It is said that this bamboo was introduced from China to Europe in 1865."

This Chinese bamboo was received by the United States Department of Agriculture from V. N. Gauntlett & Co., Chiddingfold, Surrey, England, in 1930 and accessioned under P. I. No. 89701. The original colony is under cultivation at the Garden.

A horticultural form of *P. viridis*, the Robert Young Bamboo, P. I. No.

<sup>8</sup>Data from files of Plant Introduction Section.

89718, is distinguishable from Allgold by the yellowish-green young culms at sheath-fall, the broken ring of dark green just below each sheath scar in the lower part of the culms, and the pigskinlike surface of the internodes (discernible to a sensitive touch or visible under a 9× lens).

Shoot initiation begins late. Distribution of Allgold is still limited; it apparently has not been listed by any nursery as yet.

**Phyllostachys bambusoides** Sieb. & Zucc. cv. CASTILLON McClure, Arnold Arboretum Jour. 37: 192. 1956.

Kinmei-Chiku (Japanese).

*Bambusa castilloni* Marliac ex Carrière, Rev. Hort. 58: 513. 1886.

*Phyllostachys castillonis* (Marl.) Mitf., Garden 47: 3. 1895.

*P. bambusoides* var. *castillonis* Makino, Bot. Mag. Tokyo 14: 65. 1900.

*P. quilioi* var. *castillonis* H. de Leh., Bambou, p. 29. 1906.

*P. nigra* var. *castillonis* (Mitf.) Bean, Kew B., p. 232. 1907.

*P. reticulata* var. *castillonis* (Marl.) Makino, Bot. Mag. Tokyo 26: 21. 1912.

The Castillon bamboo is distinguished from the typical form of the species by the color pattern of the culms and leaves as follows: Ground color of the culm internodes (and branches) bright yellow (sometimes suffused with dilute wine in the lower part of the culm); the internodes of culms and branches show a broad green panel on the groove above each bud or branch insertion (and in analogous positions where buds or branches do not occur); occasional leaf blades show cream stripes. The ultimate culm size of this form is considerably less than that of the typical form of the species.

The Castillon bamboo is native to China. It was introduced into Japan at an early date and by 1886 (Carrière)

it was established in cultivation in France. Japanese botanists report evidence that it is a spontaneous mutation of *P. bambusoides* (7). The original colony of P. I. No. 42659 under cultivation at the Garden developed from plants purchased from the Yokohama Nursery Co., Japan, in 1916.

As pointed out by Freeman-Mitford in his book, "The Bamboo Garden" (2), the Japanese name of this form (in translation Golden Brilliant bamboo) is appropriate and significant. The plant is highly esteemed in both China and Japan as an ornamental. Its edible young shoots have less acidity when raw than those of the typical form of the species (13). Shoot initiation begins late.

Culms of this bamboo were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

The Castillon bamboo has been listed by at least four nurseries (11).

**Phyllostachys bambusoides** Sieb. & Zucc. cv. SLENDER CROOKSTEM McClure, Arnold Arboretum Jour. 37: 194. 1956.

*P. bambusoides* Sieb. & Zucc., illustrated as an abnormal culm. Tsuboi, Illus. Jap. Sp. Bamb., ed. 2, pl. 58. 1916.

*P. bambusoides*. Variety Slender Crookstem. U. S. Dept. Agr. Some bamboos growing at the U. S. Barbour Lathrop Plant Introduction Garden, Savannah, Georgia. Mimeo., p. 7. 1947.

*P. reticulata* forma *genticulata* Nakai, Jour. Jap. Bot. 9: 34. 1933.

Slender Crookstem bamboo is distinguished from the typical form of the species by the occurrence, in a high percentage of the culms, of a peculiarity in growth habit that usually develops within 2 or 3 feet of the base of the culm. The result is one or more reciprocal curved (not abrupt) deviations

of the culm, usually an inch or so in magnitude, followed by a more or less precise return to the original vertical direction of growth. These deviations may be simple, involving only 2 or 3 consecutive internodes, or they may be compound, with 2 or more successive curves involving several internodes in a sinuous sequence. Most of the culms of Slender Crookstem are more slender in relation to their height than those of the typical form of the species. The culm nodes (both the ridge and the sheath scar) are generally less salient, with a correspondingly clear approach to straightness in the fibrovascular bundles as they pass through the nodes. Buds are borne at a lower level on culms of comparable size, and frequently more of the lower buds remain dormant than in the culm of the typical form of the species. There is often a more copious development of hairs on the culm sheaths, and these often develop on sheaths of culms of smaller size than is the rule in the typical form of the species.

Propagating material of this bamboo sent in by the writer in 1925 from Tang-wan-foh, near Tak-hing, Kwangtung Province, China, has been accessioned as P. I. No. 146420. The original colony is under cultivation at the Garden.

David Bisset, superintendent of the United States Barbour Lathrop Plant Introduction Garden, who first called attention to this form, says that its culms are preferred to the typical form of *P. bambusoides* for nut-harvesting poles.

Culms of Slender Crookstem were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

Shoot initiation begins at midseason.

The distribution of this bamboo in cultivation is still extremely limited; it apparently has not been listed by any nursery.

***Phyllostachys bambusoides* Sieb. & Zucc. cv. WHITE CROOKSTEM (new cultivar).**

White Crookstem is similar to Slender Crookstem in having many of its culms curved in a serpentine manner near the base. But its culms develop a copious deposit of white powder that persists and in the older culms obscures the green color more or less completely.

Propagating material of this bamboo sent in by the writer in 1926 from Lung-tau (Dragon Head) Mountain, Kwangtung Province, China, was accessioned as P. I. No. 66785. The original colony is under cultivation at the Garden.

Shoot initiation begins at late mid-season.

The distribution of this bamboo in cultivation is still extremely limited; it apparently is not listed by any nursery.

***Phyllostachys bissetii* McClure, Arnold Arboretum Jour. 37: 180. 1956.**

David Bisset bamboo.

(Figs. 14 and 15.)

Culms up to 22 ft. 6 in. tall and about  $\frac{7}{8}$  in. in diameter at the base (nearly 1 inch at the 10th node), erect or nearly so, except at the edge of a dense grove where they lean noticeably toward the most intense light; internodes (No. 1: 4 in. long; No. 5: 9 in. long; No. 12—the longest in a culm 22 ft. 6 in. long, with 50 internodes—13 in. long) green, loosely farinose at sheath-fall, entirely glabrous or the lower ones more or less perceptibly scabrous, being sparsely strewn in the upper half with minute erect hairs; nodal ridges only moderately prominent; sheath scars glabrous, rather strongly flared, each about as prominent as the adjacent nodal ridge; culm sheaths pale green or yellow green, weakly and irregularly tinted with



P. I. S. NEG. 88501

FIGURE 14.—*Phyllostachys bisetii* (P. I. 143540) : Young shoots from the Garden.

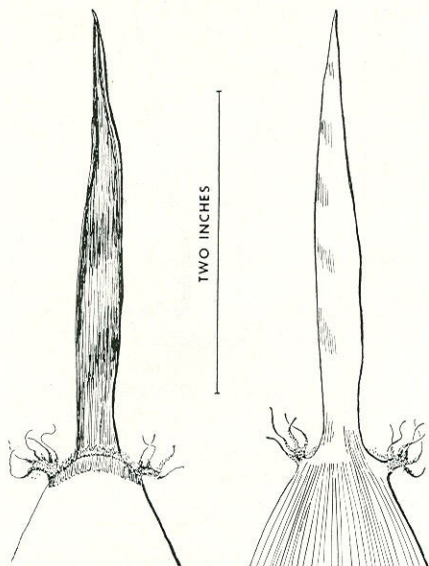


FIGURE 15.—*Phyllostachys bisetii* (P. I. No. 143540): Apex of culm sheath showing blade, ligule, and auricles. (From McClure in *Journal of the Arnold Arboretum*.)

wine, in smaller shoots principally in broad, indistinct vertical bands, in shoots of larger diameter developing a blush of pink, not spotted with dark pigment, irregularly floccose-powdery and sometimes perceptibly glaucous when fresh, thin, fissile, dusky beige on drying, the lower ones sometimes pubescent on the back and margins; auricles more or less well developed in the lower and midculm sheaths (one or the other or both sometimes obsolete), ovate, or oblong, or broadly falcate, often pinkish when fresh; oral setae few, glabrous or barely scabrous, sometimes lacking entirely; ligules maroon when fresh, covered by the sheath blade and auricles in the lower sheaths,  $\frac{1}{16}$  to  $\frac{3}{16}$  in. tall, convex at the apex, the margin more or less irregular, fringed with slender, white pubescent cilia; sheath blades of variable posture, generally appressed or slightly reflexed, sometimes strongly reflexed; narrowly triangular to ovate-lanceolate, slightly canaliculate and undulate, boat-shaped

at the apex, excurrent into auricles at the base; leaf sheaths usually auriculate; ligules moderately developed; leaf blades up to 4 in. long and  $\frac{9}{16}$  in. broad, more commonly  $2\frac{1}{4}$  to  $3\frac{1}{4}$  in. by  $\frac{3}{8}$  to  $\frac{1}{2}$  in., weakly and irregularly scabrous on the lower surface.

*P. bisetii* is in some respects rather similar to *P. aureosulcata* from which it is distinguished by the very sparse instead of dense pubescence of the lower internodes of the culm, by its lack of sharply defined color-stripping in the culm sheaths and by minor differences in the apical structure of the culm sheaths. Moreover, it lacks the yellow color panel on the groove, a stable feature characteristic of the internodes of young culms of *P. aureosulcata*.

Propagating material of this bamboo, from plants under cultivation at Cheng-tu, Szechwan Province, China, was obtained by John Tee-Van and brought to this country for the Plant Introduction Section of the United States Department of Agriculture late in 1941. The original colony, now 15 years old, is growing at the Garden, under P. I. No. 143540.

*P. bisetii* is one of the first to initiate the growth of new shoots in the spring. According to Mr. Bisset, it has shown signs of being one of the hardiest of the phyllostachids under observation at the Garden.

The distribution of this bamboo in cultivation is still extremely limited; it apparently has not been listed by any nursery.

***Phyllostachys congesta* Rendle,**  
Linn. Soc. Bot. Jour. 36: 433.  
1904.

(Figs. 16 and 17.)

Culms up to 25 ft. 4 in. tall and  $2\frac{1}{8}$  in. in diameter at the base, strongly tapered, stiffly erect or nearly so, the shoots not responding noticeably to stronger light from one side; internodes (No. 1:  $3\frac{5}{8}$  in. long; No. 5: 6 in. long; No. 17—the longest in a culm 25 ft. 4 in. long, with 54 internodes—



P. I. S. NEG. 89706

FIGURE 16.—*Phyllostachys congesta* (P. I. No. 80149): Young shoots from the Garden.

10 $\frac{5}{8}$  in. long) loosely farinose, especially below the nodes at sheath-fall, green, more or less heavily covered with gray in age, glabrous, often perceptibly but not markedly striate; nodal ridges rather prominent; sheath scars rather thick and prominently flared, glabrous; culm sheaths glabrous, dark green, with wine admixture, rarely, in the smaller culms, very faintly streaked with paler green and wine, glaucous near the base and apex; auricles commonly obsolete, their position sometimes marked by a few weak bristles (oral setae); ligules com-

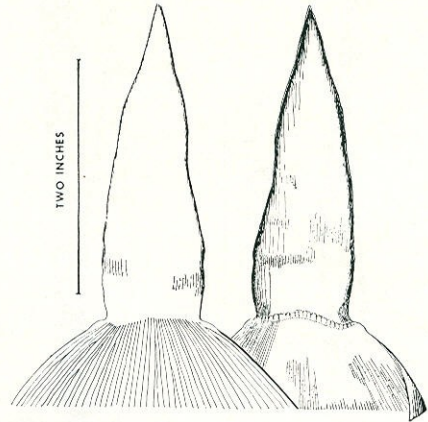


FIGURE 17.—*Phyllostachys congesta* (P. I. No. 80149): Outer (left) and inner (right) aspects of the apex of the culm sheath, showing sheath blade and ligule.

pletely covered by the blade, as wide as the blade, but very short, the apex straight to slightly convex, more or less strongly concave in the upper sheaths, the margin slightly irregular, densely fringed with minute white cilia; sheath blades broadly triangular to lanceolate, appressed and flat in the lower sheaths to trough-shaped and naviculate in the upper ones, all noticeably waved; leaf sheaths with auricles mostly reduced to a mere line of callus tissue; oral setae lacking entirely or more often few to several; ligules very short, scarcely exerted; leaf blades glabrous or nearly so except at the base on the lower surface, up to 5 $\frac{1}{8}$  in. long and  $\frac{5}{8}$  in. broad, commonly 3 to 4 in. long and  $\frac{3}{8}$  to  $\frac{1}{2}$  in. broad.

The culms are very similar in appearance to those of *P. nigra* cv. Henon, but the latter are less strongly tapered and more conspicuously coated with white powder.

The young shoots closely resemble those of *P. purpurata* cv. Straightstem, but the sheaths of the latter have the auricles and oral setae appreciably developed and Straightstem culms are less strongly tapered and have longer internodes at the base and less prominent nodes.

Material obtained by Frank N. Meyer from Tang-si, Chekiang Province, China, in 1907, is growing at the Garden under P. I. No. 80149.

Shoot initiation begins at midseason. The edible young shoots of this bamboo are among those having only a small degree of acidity, or "bite," when raw (13).

Culms of *P. congesta* were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

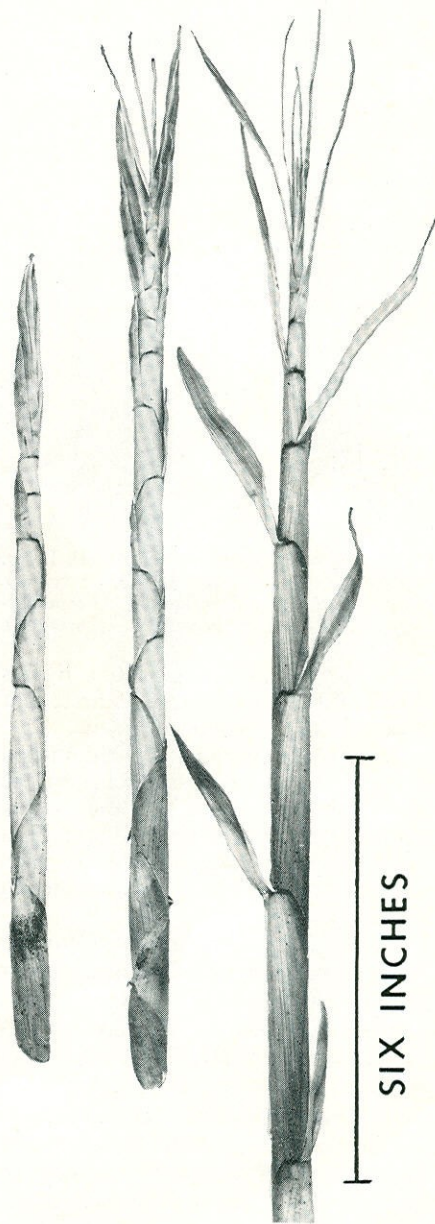
The distribution of this bamboo is still extremely limited; it apparently is not listed by any nursery.

**Phyllostachys decora** McClure,  
Arnold Arboretum Jour. 37:  
182.

(Figs. 18 and 19.)

Culms up to 23 ft.  $7\frac{1}{2}$  in. tall and  $1\frac{1}{4}$  in. in diameter, green; nodes and internodes at first sparsely strewn with very short retrorse hairs, then glabrescent, at first slightly or not at all glaucous, becoming densely pruinose below the nodes; internodes (No. 1: 3 in. long; No. 5:  $4\frac{1}{2}$  in. long; No. 11—the longest in a culm 23 ft.  $7\frac{1}{2}$  in. long— $6\frac{1}{4}$  in. long) sometimes slightly ribbed-striate; nodal ridges and sheath scars moderately and almost equally prominent, sheath scar glabrous; culm sheaths widely truncate at the apex, abruptly rounded, glabrous on the back, not at all pruinose, immaculate or sparsely strewn with minute dark spots, dark green with pale green or white stripes (sometimes almost entirely white) with a purple margin at the apex; auricles 1 or 2 or none, narrowly falcate, dark, with or without scattered brown hairs, margins fimbriate; ligules purple at first, very wide and relatively short, truncate or slightly wavy or weakly convex at the apex, the margin fimbriate with white hairs, backed by thick, scabrous dark bristles; sheath blades broadly lance-shaped to strap-shaped, abruptly acute at the apex, the lower ones appressed, the

upper ones appressed or more or less spreading, sometimes slightly undulate; leaf sheaths weakly auriculate; auricles usually small or obsolete; oral



P. I. S. NEG. 87987

FIGURE 18.—*Phyllostachys decora* (P. I. No. 128789): Young shoots from the Garden.



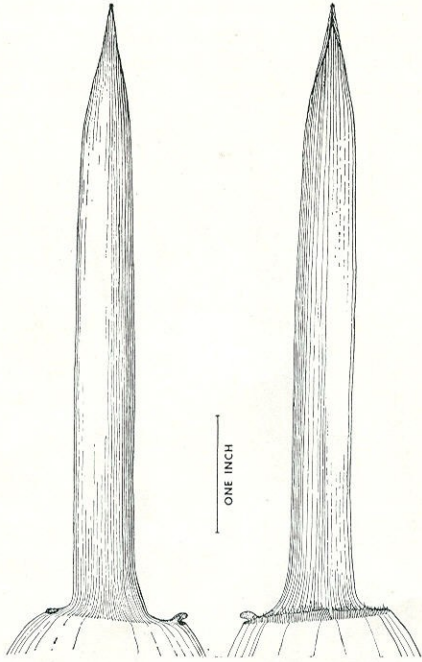


FIGURE 19.—*Phyllostachys decora* (P. I. No. 128789): Outer (left) and inner (right) aspects of the culm sheath. (From McClure in Journal of the Arnold Arboretum.)

setae few, fragile, fugacious; ligules not at all exerted, purple at first; leaf blades sparsely scabrous below.

This species is readily distinguished from all others (treated herein) by the broad truncate apex of the white-striped culm sheaths and the broad but short purple ligule exerted on each side of the broad strap-shaped sheath blade.

Plants of *P. decora* from the Hoi-wai Monastery, Lung-chi Mountain, near I-ming, Kiangsu Province, China, where it is known by the Chinese vernacular name "Mei Chu" (Beautiful bamboo), were sent by the writer to the United States Department of Agriculture in 1938. Accessioned under P. I. No. 128789, they constitute the original colony under cultivation at the Garden.

Shoot initiation takes place from early midseason to late midseason.

The distribution of this bamboo is still extremely limited; it apparently is not listed by any nursery.

***Phyllostachys dulcis* McClure,**  
Wash. Acad. Sci. Jour. 35: 285.  
1945.

Sweetshoot bamboo.

(Figs. 20 and 21.)

Culms up to 39 ft.  $\frac{1}{2}$  in. tall and  $2\frac{5}{8}$  in. in diameter at the base, strongly tapered, erect or ascending, often more or less strongly curved, the shoots leaning more or less toward the source of most intense light while growth is most active, then often becoming erect in the later stages of growth; internodes (No. 1:  $4\frac{1}{8}$  in. long; No. 5:  $9\frac{1}{2}$  in. long; No. 15—the longest in a culm 39 ft.  $\frac{1}{2}$  in. long, with 57 internodes— $13\frac{1}{4}$  in. long) dull green, often finely striped with cream or paler green, bearing rather abundant loose powder, especially below the nodes at sheath-fall, usually heavily covered with this deposit in age; glabrous, strongly and somewhat unevenly ribbed-striate; nodal ridges fairly prominent, noticeably thickened on the convex side of the curved culms; sheath scars rather thick, abruptly flared, glabrous; culm sheaths somewhat glaucous, glabrous, or with scattered stiff erect hairs, greenish cream, sparsely strewn with small brown spots and usually more or less striped with white and sometimes tinged with lavender or pale rose when fresh, pale straw to nearly white, thin, fissile and showing salient veins when dry; auricles well-developed, narrow, falcate, fringed with well-developed, crinkled oral setae; ligules strongly convex, weakly ciliate on the undulate margin, decurrent in the lower sheaths; sheath blades lance-shaped to strap-shaped, boat-shaped, especially toward the tip, strongly crinkled, appressed or slightly spreading away from the culm in the lower sheaths, arched or drooping in the upper ones; leaf sheaths with auricles and oral setae strongly devel-



P. I. S. NEG. 37327

FIGURE 20.—*Phyllostachys dulcis* (P. I. No. 73452) : Culm and young shoots from the Garden.

oped to lacking entirely; ligules strongly exerted, ciliate on the margin; leaf blades up to  $5\frac{1}{4}$  in. long and  $1\frac{3}{16}$  in. broad, more commonly  $3\frac{5}{8}$  to 4 in. by  $\frac{5}{8}$  to  $\frac{3}{4}$  in., of variable vesture, usually densely pilose, at least toward

the base, sometimes throughout on the lower surface.

This species is perhaps most likely to be confused with *P. elegans*. The latter may be distinguished from *P. dulcis* by the narrow apex of the culm

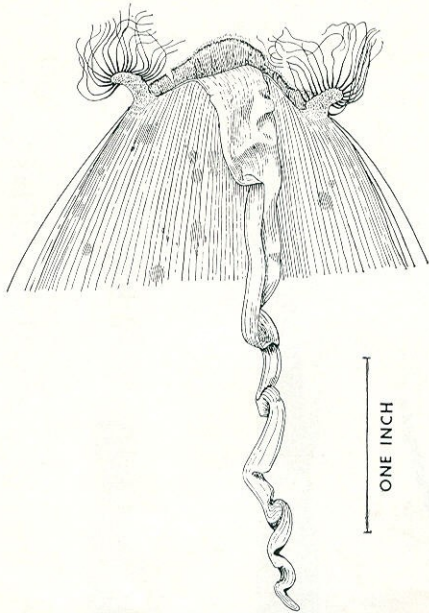


FIGURE 21.—*Phyllostachys dulcis* (P. I. No. 73452): Apex of culm sheath, showing sheath blade, ligule, and auricles.

sheaths, which are darker, not striped, more densely maculate, by the more erect, straighter culm habit, by the shorter internodes in the lower part of the culm, by the finer and more even striation of the internodes, by the much smaller leaf blades that are broader in proportion to length, and by the presence of rusty-brown "freckles," on the culm internodes where these are exposed to direct sunlight.

The Sweetshoot bamboo is under cultivation at the Garden under P. I. No. 73452. It represents one of the introductions of Frank N. Meyer, who described it as "the edible bamboo of Central China." The late E. A. McIlhenny rated it as the most rapidly growing and most prolific of the bamboos in his collection. The specific epithet and the common name allude to the superior palatability of the young shoots.

Shoot initiation begins very early in the season.

Culms of this bamboo were included in studies on seasoning and physical

properties carried out at Clemson Agricultural College of South Carolina (3).

*P. dulcis* is hardy at Glenn Dale, Md., and in Washington, D. C.; its minimum temperature tolerance has been estimated at  $-4^{\circ}$  F.<sup>9</sup> It is very limited in its distribution; at least two nurseries have listed it (11).

***Phyllostachys elegans* McClure,**  
Arnold Arboretum Jour. 37:  
183. 1956.

(Figs. 22 and 23.)

Culms up to 32 ft. 5 in. tall and  $2\frac{1}{4}$  in. in diameter at the base, rather evenly tapered from base to tip, fairly straight, erect or nearly so, not appreciably affected by more light from one

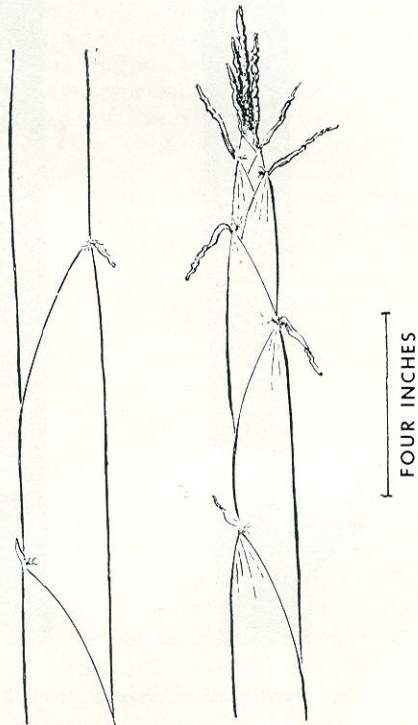


FIGURE 22.—*Phyllostachys elegans* (P. I. No. 128778): Field sketch of a young shoot from the Garden.

<sup>9</sup> Data from files of Plant Introduction Section.

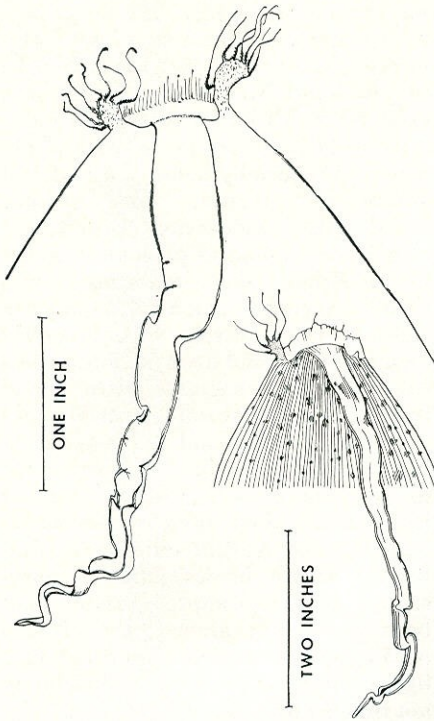


FIGURE 23.—*Phyllostachys elegans* (P. I. No. 128778): Apex of culm sheath, showing sheath blade, ligule, and auricles. Inset shows specimen with only one auricle developed; the margin of the ligule here has lost most of the original fringe of cilia. (From McClure in *Journal of the Arnold Arboretum*.)

side during active growth; internodes (No. 1: 1 in. long; No. 5: 5 $\frac{3}{8}$  in. long; No. 21—the longest in a culm 32 ft. 5 in. long, with 65 internodes—12 $\frac{1}{4}$  in. long) glabrous, finely and evenly ribbed-striate, dull green at first, later obscurely speckled with tiny, rusty-brown spots where exposed to full sunlight, rather conspicuously glaucous with loose powder at sheath-fall, this not greatly increasing in age; nodal ridges narrow, not very prominent; sheath scars thin, glabrous, about as prominent as the nodal ridges; culm sheaths somewhat glaucous, olive green, sometimes suffused with lavender, moderately to rather densely maculate with

small brown spots, scabrous to the touch, especially toward the margins near the apex, sometimes sparsely strewn with erect bristles; auricles 1 to 2, occasionally lacking, slender, falcate, bordered apically with prominent, crinkled oral setae; ligules well developed, weakly convex, fimbriate on the margin with scabrous bristles; sheath blades lance-shaped to strap-shaped or narrowly triangular, usually more or less strongly crinkled, spreading to more or less strongly arched or bent back; leaf sheaths commonly tinted with wine, with auricles usually well developed and fringed with oral setae; ligules slightly exserted, weakly ciliate on the margin; leaf blades lance-shaped, up to 4 in. long and  $\frac{3}{4}$  in. broad, more commonly less than 3 $\frac{1}{8}$  in. long and  $\frac{3}{4}$  in. broad, densely pubescent throughout on the lower surface.

*P. elegans* is set off rather clearly from the other species of the genus by the relatively small, lance-shaped leaf blades that are generally more densely pubescent on the lower surface than those of most species. In superficial characters it resembles *P. dulcis*. *P. elegans* may be distinguished from *P. dulcis* by the narrower apex of the culm sheaths, which are darker, not striped, and more densely maculate, by the more erect, straighter culm habit, by the shorter internodes in the lower part of the culm, by the finer and more even striation of the internodes, by the much smaller leaf blades, which are broader in proportion to length, and by the presence of rusty-brown "freckles" on the culm internodes where these are exposed to direct sunlight. In general appearance of the culm sheaths, *P. elegans* resembles *P. viridi-glaucescens* with which it was earlier confused. The latter has a longer ligule on the culm sheaths, larger, longer, differently shaped and nearly glabrous leaf blades, and perfectly smooth culm internodes without a sign of striation.

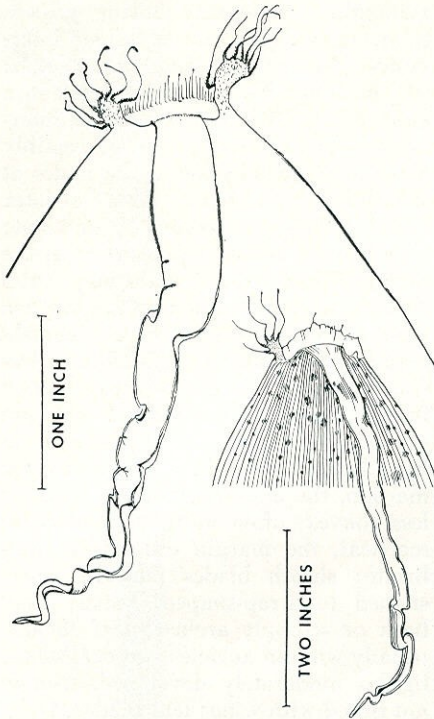


FIGURE 23.—*Phyllostachys elegans* (P. I. No. 128778): Apex of culm sheath, showing sheath blade, ligule, and auricles. Inset shows specimen with only one auricle developed; the margin of the ligule here has lost most of the original fringe of cilia. (From McClure in *Journal of the Arnold Arboretum*.)

side during active growth; internodes (No. 1: 1 in. long; No. 5:  $5\frac{3}{8}$  in. long; No. 21—the longest in a culm 32 ft. 5 in. long, with 65 internodes— $12\frac{1}{4}$  in. long) glabrous, finely and evenly ribbed-striate, dull green at first, later obscurely speckled with tiny, rusty-brown spots where exposed to full sunlight, rather conspicuously glaucous with loose powder at sheath-fall, this not greatly increasing in age; nodal ridges narrow, not very prominent; sheath scars thin, glabrous, about as prominent as the nodal ridges; culm sheaths somewhat glaucous, olive green, sometimes suffused with lavender, moderately to rather densely maculate with

small brown spots, scabrous to the touch, especially toward the margins near the apex, sometimes sparsely strewn with erect bristles; auricles 1 to 2, occasionally lacking, slender, falcate, bordered apically with prominent, crinkled oral setae; ligules well developed, weakly convex, fimbriate on the margin with scabrous bristles; sheath blades lance-shaped to strap-shaped or narrowly triangular, usually more or less strongly crinkled, spreading to more or less strongly arched or bent back; leaf sheaths commonly tinted with wine, with auricles usually well developed and fringed with oral setae; ligules slightly exserted, weakly ciliolate on the margin; leaf blades lance-shaped, up to 4 in. long and  $\frac{3}{4}$  in. broad, more commonly less than  $3\frac{1}{8}$  in. long and  $\frac{3}{4}$  in. broad, densely pubescent throughout on the lower surface.

*P. elegans* is set off rather clearly from the other species of the genus by the relatively small, lance-shaped leaf blades that are generally more densely pubescent on the lower surface than those of most species. In superficial characters it resembles *P. dulcis*. *P. elegans* may be distinguished from *P. dulcis* by the narrower apex of the culm sheaths, which are darker, not striped, and more densely maculate, by the more erect, straighter culm habit, by the shorter internodes in the lower part of the culm, by the finer and more even striation of the internodes, by the much smaller leaf blades, which are broader in proportion to length, and by the presence of rusty-brown "freckles" on the culm internodes where these are exposed to direct sunlight. In general appearance of the culm sheaths, *P. elegans* resembles *P. viridi-glaucescens* with which it was earlier confused. The latter has a longer ligule on the culm sheaths, larger, longer, differently shaped and nearly glabrous leaf blades, and perfectly smooth culm internodes without a sign of striation.

Propagating material of *P. elegans*, obtained at Ta-ts'it near Hung-mo Mountain, Tan District, Hainan Island, China, was sent by the writer to the United States Department of Agriculture in 1938. It is growing at the Garden under P. I. No. 128778. The local Chinese (Cantonese) name "Fa Chuk" (Flowered or Embroidered bamboo) alludes to the maculation of the culm sheaths. An earlier introduction representing what appears to be a somewhat less vigorous strain of the species is P. I. No. 110511, obtained by the writer at Mung-haang, Ts'ing-yuen District, Kwangtung Province, China, and sent to the United States Department of Agriculture in 1936. The Chinese (Cantonese) vernacular name used in the latter locality—"Man Sun" or "Man Chuk" (Elegant Shoot or Elegant bamboo)—was taken as the basis for the specific epithet.

Shoot initiation begins very early in the season.

Culms of *P. elegans* (under P. I. No. 128778) were included (under the name *P. viridi-glaucescens*) in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

The distribution of *P. elegans* in cultivation is still extremely limited; apparently it is not listed by any nursery. It is likely to be esteemed for the superior flavor and quality of its shoots and for the beauty of the plant as an ornamental rather than for its culms, whose technical properties make a relatively poor showing.

***Phyllostachys flexuosa* A. & C. Riv.,**  
Soc. Acclim. B. Ser. 3, 5: 758.  
1878.

(Figs. 24 and 25.)

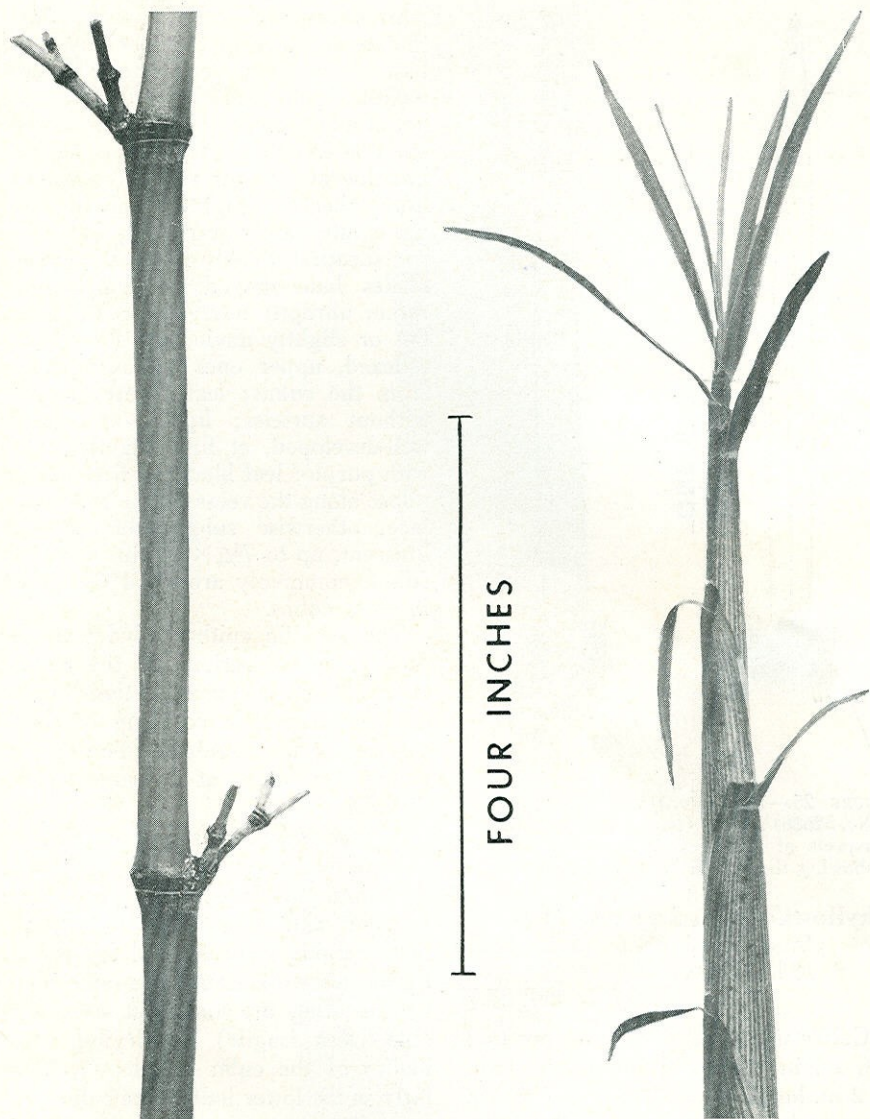
Culms up to 30 ft. 10 in. tall and  $2\frac{3}{4}$  in. in diameter at the base, erect or nearly so, straight or more often somewhat zigzag (occasionally with one to several strongly geniculate nodes), not

responding noticeably during growth to stronger light from one side; internodes (No. 1:  $2\frac{3}{4}$  in. long; No. 5:  $9\frac{1}{2}$  in. long; No. 13—the longest in a culm 30 ft. 10 in. long, with 54 internodes—14 in. long) green, perceptibly glaucous especially below the nodes at sheath-fall, glabrous, ribbed-striate; nodal ridges moderately prominent; sheath scars about as prominent as the nodal ridges, thin, glabrous; culm sheaths greenish beige with purplish close-set veins, rarely with greenish-cream streaks, and always more or less conspicuously maculate with small brown areas, glabrous, lustrous, not glaucous; auricles and oral setae lacking; ligules strongly developed, dark maroon, the apex truncate to more or less convex, often more or less asymmetrical, the margin ciliate to fimbriate; sheath blades narrow, lance-shaped to strap-shaped, mostly bent back or strongly arched; leaf sheaths usually without auricles and oral setae; ligules moderately developed, usually not tinted with wine; leaf blades  $2 \times \frac{3}{8}$  in. to  $6 \times \frac{3}{4}$  in., more or less densely tomentose to subglabrous (except at the base) on the lower surface.

This Chinese species reached the United States via France in 1921 through the agency of Vilmorin-Andrieux & Co., whence the United States Department of Agriculture received plants now growing at the Garden under P. I. No. 52686. Another introduction growing at the Garden is P. I. No. 116965, which differs from P. I. No. 52686 principally in the less strongly convex ligule of the culm sheaths.

Shoot initiation begins in early mid-season. The shoots, though small, are very palatable, being relatively free from acidity, or "bite," even in the raw state (13).

Culms of *P. flexuosa* (under P. I. No. 52686) were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).



P. I. S. NEGS. 37362, 37360

FIGURE 24.—*Phyllostachys flexuosa* (P. I. No. 52686) : Culm and young shoot from the Garden.

Its minimum temperature tolerance has been estimated at 5° F.,<sup>10</sup> but it

<sup>10</sup> Data from files of Plant Introduction Section.

appears to be hardy at Glenn Dale, Md., and Washington, D. C. The plant has been rather widely distributed for trial, and is listed by at least three nurseries (11).

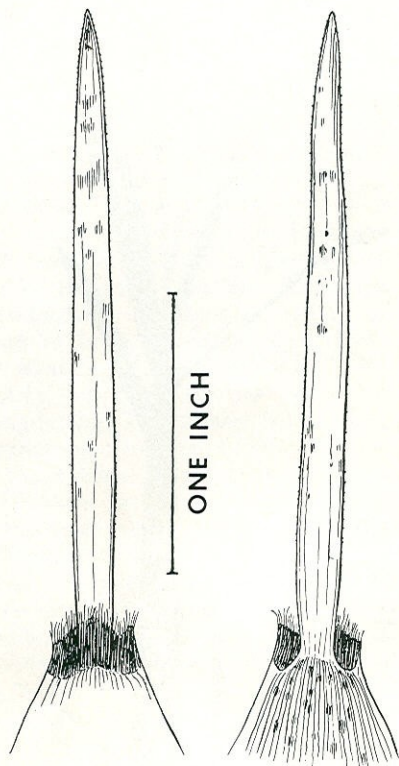


FIGURE 25.—*Phyllostachys flexuosa* (P. I. No. 52686): Inner (left) and outer (right) aspects of the apex of the culm sheath, showing the sheath blade and ligule.

***Phyllostachys glauca*** McClure,  
Arnold Arboretum Jour. 37:  
185. 1956.

(Figs. 26 and 27.)

Culms up to 33 ft.  $6\frac{3}{4}$  in. tall and  $1\frac{7}{8}$  in. in diameter; internodes (No. 1: 2 in. long; No. 5:  $8\frac{3}{4}$  in. long; No. 14—the longest in a culm 33 ft.  $6\frac{3}{4}$  in. long, with 51 internodes— $16\frac{1}{2}$  in. long) green, glabrous throughout, beautifully pruinose with white powder at sheath-fall, not ribbed-striate, straight or very rarely slightly bent at the base; nodal ridges and sheath scars moderately and almost equally prominent, the sheath scar glabrous; culm sheaths narrowly truncate at the apex, glabrous on the back, green throughout,

more or less suffused with wine, with a few small brown spots, especially at the base and apex, occasionally almost without spots; auricles and oral setae not at all developed; ligules dark, wide and relatively short, truncate or slightly undulate at the apex, rarely (only in the lower sheaths) slightly concave, margin ciliate, rarely (especially in the upper sheaths) weakly fimbriate; sheath blades lance-shaped to strap-shaped, rather abruptly narrowed at the apex, flat or slightly naviculate, lower ones reflexed, upper ones spreading away from the culms; leaf sheaths usually without auricles; ligules moderately well-developed, at first slightly tinted with purple; leaf blades at first weakly pilose along the veins on the lower surface, otherwise subglabrous or glabrescent, up to  $7\frac{1}{4} \times 1\frac{1}{4}$  in. in young culms, commonly around  $4\frac{5}{8} \times \frac{3}{4}$  in. in older culms.

The specific epithet alludes to the distinctive coloration of the young culms, which is caused by their evenly distributed overall covering of white powder by which this bamboo can be recognized even at a considerable distance.

*P. glauca* is very similar to *P. flexuosa* in many respects. The ligules of the culm sheaths in *P. glauca* are broader and shorter in proportion, more strictly truncate, and fringed on the margin with minute cilia rather than bristles; they are somewhat more durable (less fragile) on drying. The blades of the culm sheaths (particularly in the lower half of the culm) are appreciably broader in proportion to their length, and more abruptly narrowed at the tip than those of *P. flexuosa*. The culm sheaths in *P. glauca* are appreciably thicker and tougher in texture, with generally fewer and more discrete dark spots than those of *P. flexuosa*. Plants of *P. glauca* (P. I. No. 77011) show greater vigor and larger ultimate stature than those of *P. flexuosa* (P. I. Nos. 52686, 116965)





P. I. S. NEGS. 37362, 37361

FIGURE 26.—*Phyllostachys glauca* (P. I. No. 77011): Culm and young shoots from the Garden.

under apparently identical growing conditions.

Rhizomes of this species, from a garden in Nanking, Kiangsi Province, China, were sent to the United States Department of Agriculture by the writer in 1926. They gave rise to rooted plants that survived quarantine

and ultimately became established as P. I. No. 77011 at the Garden.

Shoot initiation begins in early mid-season. The shoots are very palatable, being relatively free from acidity, or "bite," even in the raw state (13).

Culms of this bamboo were included (under the name *P. flexuosa*) in studies

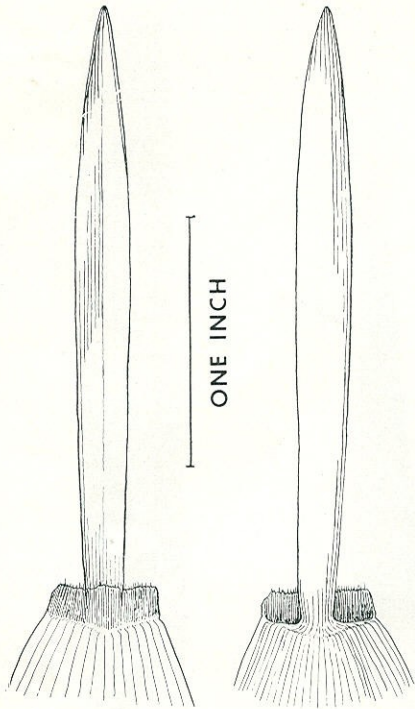


FIGURE 27.—*Phyllostachys glauca* (P. I. No. 77011): Inner (left) and outer (right) aspects of the culm sheath, showing the sheath blade and ligule. (From McClure in *Journal of the Arnold Arboretum*.)

on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

*P. glauca* is very limited in its distribution, and apparently is not listed by any nursery. It has not been tried as far north as Washington, D. C., and its minimum temperature tolerance is not known.

***Phyllostachys makinoi* Hayata, Icon. Pl. Formosa 5: 250. 1915.**

Makino bamboo.

(Figs. 28 and 29.)

Culms up to 60 ft. and more in height and  $2\frac{5}{8}$  in. in diameter 3 ft. above the ground (teste Hayata), up to 12 ft. high and  $\frac{5}{8}$  in. in diameter in 4-year-old plants, stiffly erect; internodes pale green with purplish-brown

spots just above the nodes, glabrous and glaucous throughout at sheath-fall, the covering of powder densest, but not sharply zoned, just below each node and gradually thinner downward, rapidly becoming thicker throughout the internode immediately after sheath-fall, giving a pale, blue-green overall effect, nodal ridges and sheath scars of moderate prominence, the latter thin, without hairs; culm sheaths of pale green, glabrous, sparsely to somewhat densely strewn with dusky or smoky-brown spots, white powder barely perceptible or none; auricles and oral setae lacking; ligules truncate, prominently fringed with dark bristles (red when fresh), dark brown when dry; sheath blades lance-shaped to strap-shaped, spreading in the lower sheaths to broadly arched or drooping in the upper ones, pale green, sometimes more or less strongly tinted with wine, with a broad white or cream border; leaf sheaths bearing auricles and oral setae;

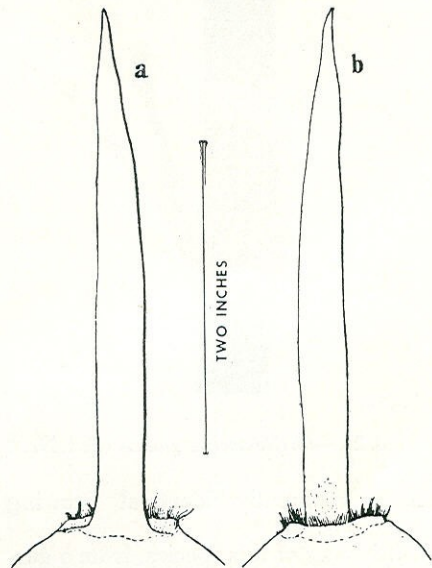


FIGURE 28.—*Phyllostachys makinoi*: Hayata's original illustration of the apex of the culm sheath—outer (a) and inner (b) aspects. (From *Icones Plantarum Formosanarum*, vol. 6, fig. 52, p. 142. 1916. Scale added.)

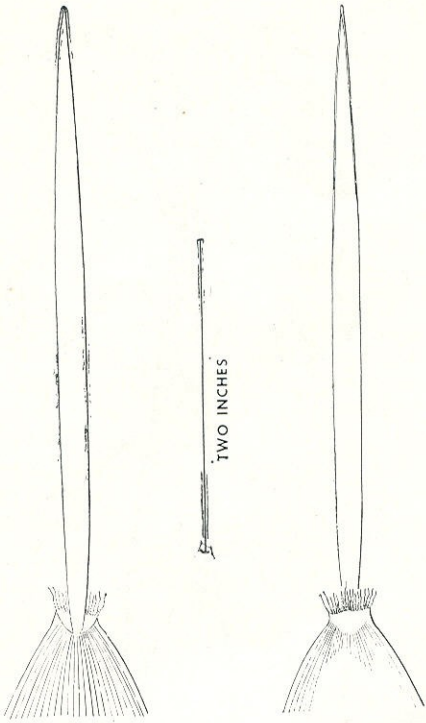


FIGURE 29.—*Phyllostachys makinoi* (P. I. No. 195284): Outer (left) and inner (right) aspects of a representative culm sheath from a young plant at the Garden.

ligules well developed, pale green to smoky.

This description was drawn up principally on the basis of young plants at the Garden under P. I. No. 195284 introduced from Formosa in 1951.

From *P. bambusoides*, with which it was earlier confused in Formosa, *P. makinoi* is easily distinguishable by having its culm internodes glaucous at sheath-fall, the surface of the culm internodes pigskinlike and the ligule of the culm sheath more densely fimbriate. The young plants of *P. makinoi* at the Garden closely resemble the young plants of *P. viridis* and may prove to belong to that species when they have reached a more mature stature.

During World War II culms of *P. makinoi* were imported into this country from Formosa for rug poles and material for making split bamboo fishing

rods. For the latter purpose, however, there is really no satisfactory substitute for the Tonkin cane (*Arundinaria amabilis* McClure).

Shoot initiation begins at midseason.

*P. makinoi* has not been distributed for trial in the United States.

**Phyllostachys meyeri** McClure,  
Wash. Acad. Sci. Jour. 35: 286.  
1945.

(Figs. 30 and 31.)

Culms up to 32 ft. 10½ in. tall and 17⁄8 in. in diameter at the base, erect, straight or nearly so, rarely somewhat flexuose at the nodes near the base, not appreciably affected during growth by stronger light from one side; internodes (No. 1: 1 in. long; No. 5: 6¾ in. long; No. 8—the longest in a culm 32 ft. 10½ in. long, with 55 internodes—14 in. long) green, perceptibly glaucous especially below the nodes at sheath-fall, entirely glabrous, not at all ribbed-striate; nodal ridges moderately prominent; sheath scars about as prominent as the nodal ridges, thin, sharp, fringed with minute white hairs; culm sheaths greenish buff, spotted and more or less blotched with small brown areas, perceptibly glaucous, fringed along the base with a narrow band of small white hairs, otherwise entirely glabrous even on the margins; auricles and oral setae none; ligules exserted, of medium length, the apex convex with a hump in the middle, often slightly asymmetrical, the margin ciliate at first, soon glabrescent and smooth; sheath blade lance-shaped to narrowly strap-shaped, very long in the midportion of the culm, broadly arched, more or less wavy to slightly crinkled; leaf sheaths with auricles and oral setae usually weak or lacking; ligules prominently exserted, the apex strongly convex, the margin glabrous or sparsely ciliate, delicate and frangible when dry; leaf blades up to 6 in. and more in length and 1½ in. broad, commonly 3 or 4 in. × 1½ to ¾ in., densely pilose at the base and decreasingly so toward the apex on the lower surface.

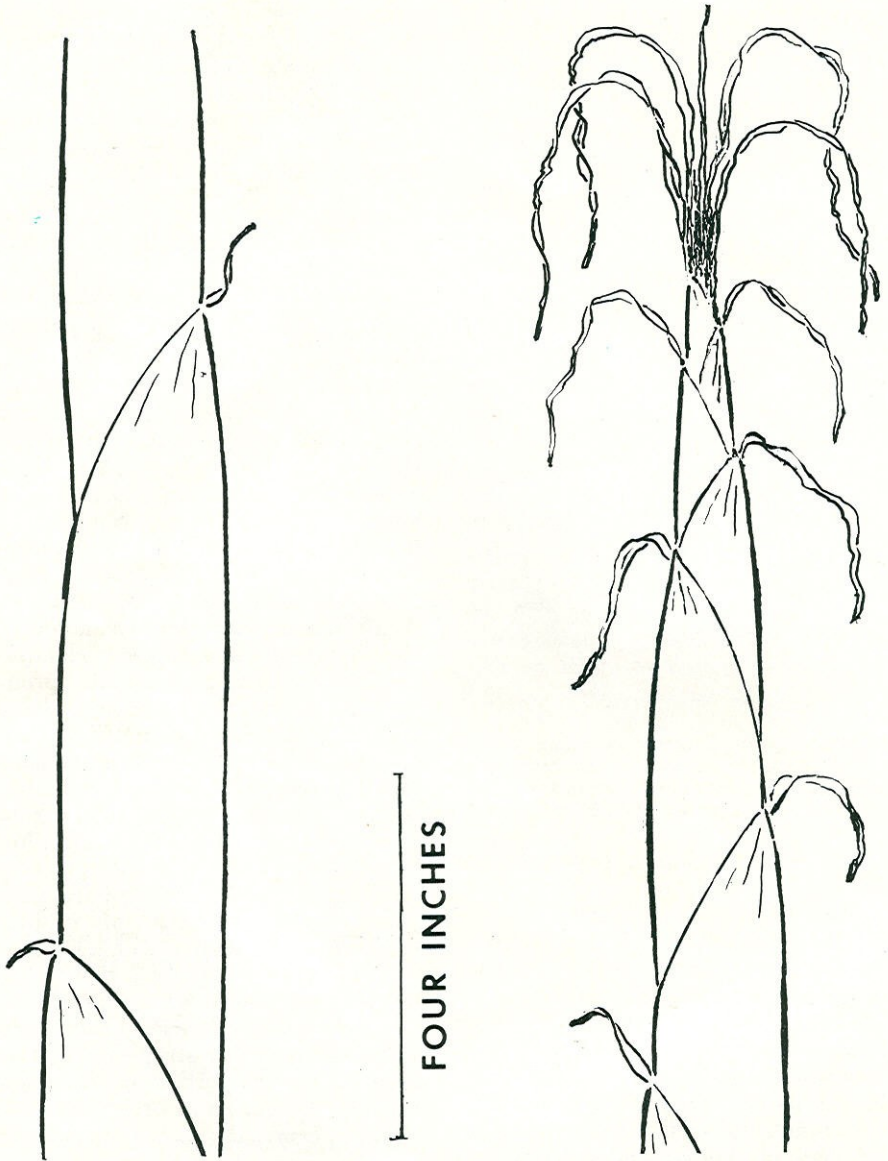


FIGURE 30.—*Phyllostachys meyeri* (P. I. No. 116768): Field sketch of a young shoot from the Garden.

*P. meyeri* is most apt to be confused with *P. aurea* and *P. propinqua*. *P. meyeri* may be distinguished from *P. aurea* by the longer, humped, less prominently fringed ligule of the culm sheath, and from *P. propinqua* by the presence of the fringe of white hairs on

the border of the base of the culm sheath. *P. propinqua* has more lustrous culm sheaths than *P. meyeri*, with blades relatively smaller in all dimensions.

*P. meyeri* was obtained in the vicinity of Tang-si, Chekiang Province,

China, by Frank N. Meyer in 1907. It is growing at the Garden under P. I. No. 116768.

Shoot initiation begins at midseason.

Culms of this bamboo were included in studies on seasoning and physical properties carried out at Clemson Agri-

cultural College of South Carolina (3).

One of the finest, strongest, and most versatile bamboos of this genus, the Meyer bamboo has been somewhat widely distributed for trial in the United States; it is estimated to have a minimum temperature tolerance of

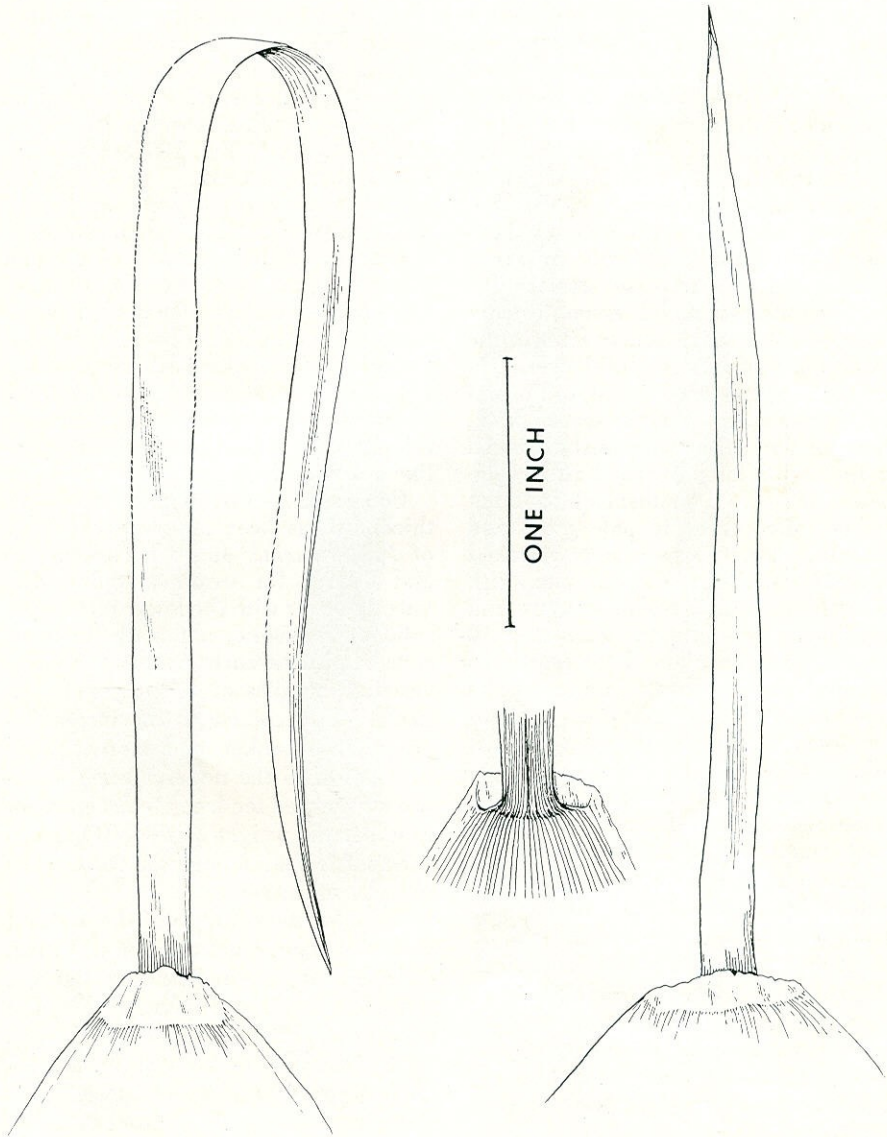


FIGURE 31.—*Phyllostachys meyeri* (P. I. No. 116768): Apex of culm sheath, showing sheath blade and ligule.

—4° F.<sup>11</sup> It is listed by at least three nurseries (11), and has proved to be a very satisfactory hedge plant (4).

**Phyllostachys nidularia** Munro,  
Gard. Chron. (n. s.) 6: 773. 1876.  
(Figs. 32 and 33.)

Culms up to 33 ft. tall and 1½ in. in diameter at the base, straight and erect, occasionally more or less sinuous, often more or less arched under the weight of the foliage, not appreciably affected during growth by stronger light from one side; internodes (No. 1: ¾ in. long; No. 5: 7 in. long; No. 14—the longest in a culm 28 ft. 8 in. long, with 46 internodes—15⅝ in. long) green, copiously and more or less loosely farinose at sheath-fall, glabrous or (very rarely) sparsely retrorse setulose below the nodes, soon glabrescent, usually more or less conspicuously ribbed, the lower ones sometimes solid or nearly so; nodal ridges very broad and prominently salient; sheath scars thick, strongly flared, conspicuously fringed at first with long brown hairs; glabrous in cv. Smoothsheath); culm sheaths olive green to pale green and white, the lower ones usually streaked vertically with these tints and with wine, loosely farinose near apex and base, retrorse hirsute with shaggy brown hairs near the base, glabrous elsewhere on the back in the typical form of the species (glabrous throughout in cv. Smoothsheath), the margins ciliate; auricles very large, ventricose, often more or less crinkled, clasping, sometimes broadly falcate; oral setae few, small, distant, inconspicuous, ligules completely covered by the sheath blade, short, the apex slightly to strongly convex, rarely almost straight, sometimes more or less asymmetrical, the margin densely white ciliolate; sheath blades large, appressed, more or less inflated, broadly spear-shaped, continuous below on either side into the auricles; leaf sheaths usually with auricles and oral setae weakly devel-

oped or lacking; ligules very short, not exerted, leaf blades up to 5½ in. long and 11/16 in. broad, more commonly 3 or 4 in. long and 5/8 in. broad, glabrous or nearly so on the lower surface.

This species is strongly characterized by very prominent culm nodes, by large and distinctively shaped culm sheath blades, and by large ventricose auricles. Therefore, it is not apt to be confused in the field with any other bamboo known at present.

The typical form is represented at the Garden by P. I. Nos. 63696, 63697, 63757, 66786, 67399, 128769, 128772, 128779, and 128812, sent in by the writer from various parts of China. Vernacular (Cantonese) names are recorded as follows: Taai Ngaan Chuk (Big-noded bamboo), Kan Chuk (Bamboo-with-slender-indeterminate-rhizomes), So Pa Chuk (Broom bamboo), Kam Sz Chuk (Golden Silk bamboo—a fanciful name alluding to the anthers of the flowering plant), and Pat Sun Chuk (Bamboo-with-shoots-shaped-like-a-writing-brush).

Considerable variation in culm-wall thickness has been observed in plants of *P. nidularia*. In P. I. Nos. 66786 and 67399, for example, culms frequently occur with the lower internodes solid or semisolid, and with an inner zone of pith parenchyma poor in fibrovascular bundles or lacking them entirely. In these culms the internodes are often shrunken and more slender in relation to the nodes. Such culms show a marked tendency to arch broadly under the weight of their foliage.

Shoot initiation begins at the Garden in early midseason.

This bamboo supplies the earliest shoots to the market at Canton, China, in the spring, at which season "Pat Sun and chicken" is a popular dish. The shoots of *P. nidularia* (P. I. No. 128779) grown at the Garden are entirely without acidity, or "bite," even in the raw state. Those from P. I. No. 128812 are said to have a flavor, when cooked, like that of cooked whole hominy (13). The culms of this species

<sup>11</sup> Data from files of Plant Introduction Section.



P. I. S. NEG. 89716

FIGURE 32.—*Phyllostachys nidularia*, typical form (P. I. No. 128812): Young shoots from the Garden.

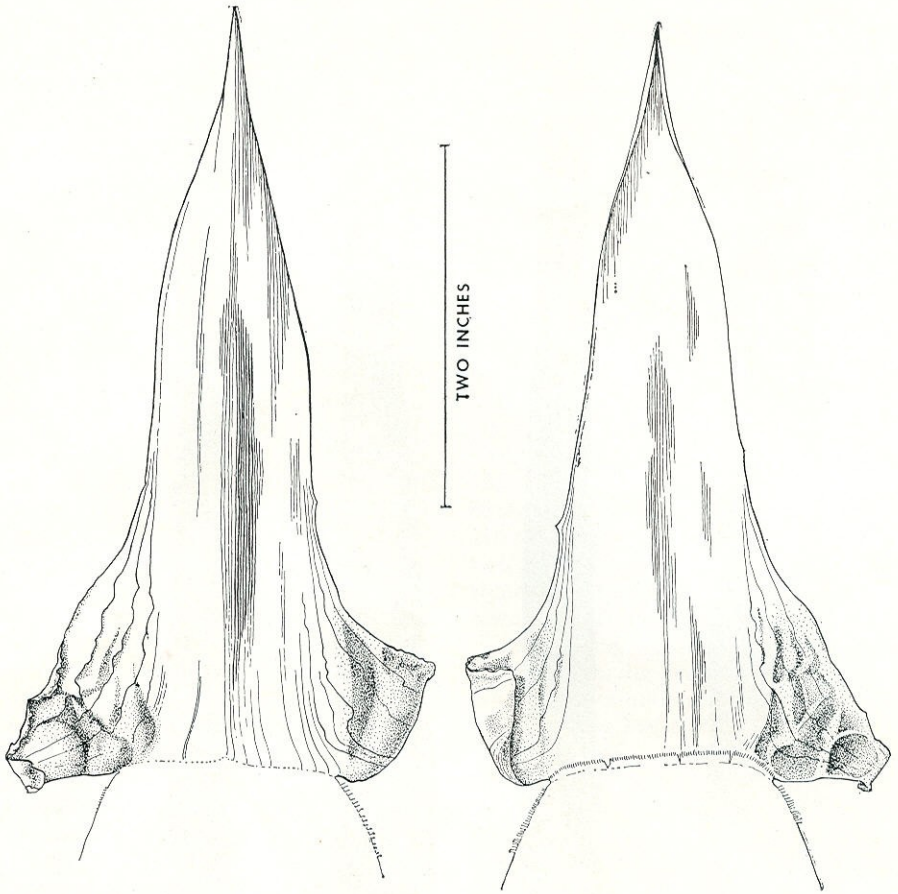


FIGURE 33.—*Phyllostachys nidularia*, typical form (P. I. No. 63696): Outer (left) and inner (right) aspects of the apex of the culm sheath.

are strong and generally useful in the natural state but do not split well.

Culms of *P. nidularia* (under P. I. No. 63697) were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

The plant is very limited in its distribution and apparently is not listed by any nursery. Its minimum temperature tolerance is not known. The vigor of plants of this species and their widespread occurrence in China, both in the wild and in cultivation, indicate this species is worthy of trial for soil and water stabilization on watersheds and levees and for the production of

edible shoots, which are among the best for flavor.

***Phyllostachys nidularia* cv. SMOOTHSHEATH** (new cultivar).

The cultivar is characterized by a lack of the shaggy brown retrorse pubescence that clothes the basal part of the culm sheaths and the sheath scars in the typical form of the species.

This "small bamboo with edible shoots" occurs wild on Cheung-chow (an island in the West River), Teng District, Kwangsi Province, China, where it is known as "Chan Chuk" (Cantonese). Propagating material was sent in by the writer in 1924, and



a colony under P. I. No. 128776 is under cultivation at the Garden. Shoot initiation begins in early midseason.

*P. nidularia* cv. Smoothsheath is very limited in its distribution and apparently is not listed by any nursery. Its minimum temperature tolerance is not known.

***Phyllostachys nigra* (Lodd.)**

Munro, Linn. Soc. Trans. 26: 38. 1868.

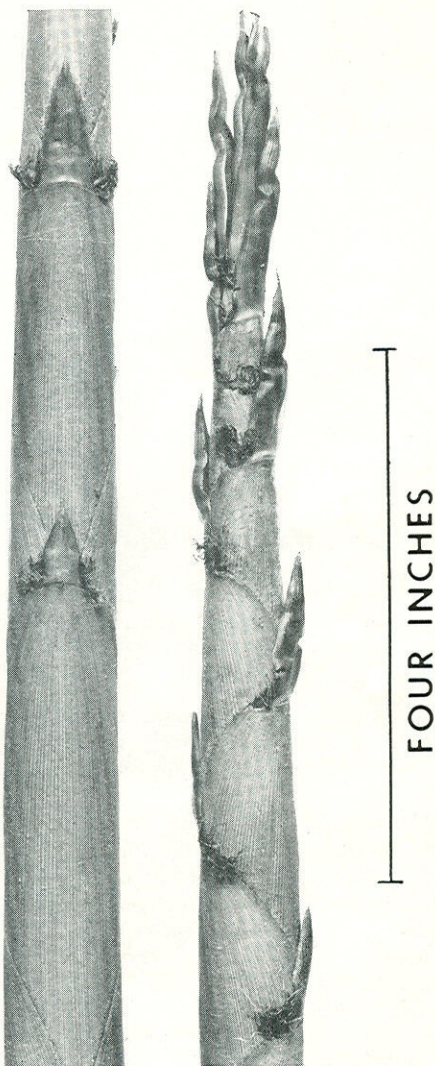
Black bamboo; Kuro-Chiku (Japanese).<sup>12</sup>

(Figs. 34 and 35.)

*Bambusa nigra* Lodd. ex Lindl., Penny Cyclop. 3: 357. 1835.

*Phyllostachys puberula* var. *nigra* H. de Leh., Cong. Internatl. Bot. 3, Actes 2: 223. 1912.

Culms up to 25 ft. 11 in. tall and 1¼ in. in diameter (larger in cv. Bory and cv. Henon); internodes (No. 1: 3¾ in. long; No. 5: 8½ in. long; No. 15—the longest in a culm of the typical form 25 ft. 11 in. long, with 43 internodes—12⅝ in. long) green at first in all the forms (remaining so in cv. Henon, the lower ones developing a few isolated purplish to brown spots in cv. Bory), gradually becoming speckled, then more or less completely covered, with purplish to brownish to black spots in the typical form, more or less copiously and loosely farinose at sheath-fall, of variable vesture, often sparsely to densely setulose (almost velvety) at first, then glabrescent, sometimes glabrous from the first (especially in small culms), the surface usually smooth but sometimes perceptibly ribbed-striate; nodal ridges moderately prominent; sheath scars about as prominent as the nodal ridges, thin, usually flared, glabrous or fringed with brown hairs; culm sheaths greenish buff to pale buff to ruddy buff, not at all maculate, usually more or less generally but sparsely pubescent with erect hairs; sheath blades broadly to narrowly triangular,



P. I. S. NEG. 37330

FIGURE 34.—*Phyllostachys nigra*, typical form (P. I. No. 66784): Young shoots from the Garden.

boat-shaped, more or less wavy, increasingly so in larger culms, appressed in the lower sheaths, spreading away from the culm in the upper ones; leaf sheaths with auricles and oral setae usually weak or lacking; ligules very short, scarcely exerted; leaf blades commonly up to 3⅝ in. long and up to ½ in. broad, exceptionally up to 5

<sup>12</sup> Common names of the typical form.

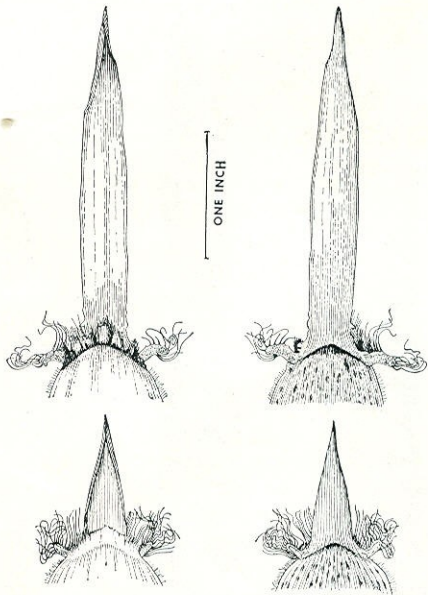


FIGURE 35.—*Phyllostachys nigra*, typical form (P. I. No. 66784): Inner (left) and outer (right) aspects of the apex of culm sheaths.

in. long and  $\frac{3}{4}$  in. broad, usually glabrous or nearly so, rarely sparsely to densely pilose throughout on the lower surface.

Owing to the distinctive coloration of the older culms in the typical form, *P. nigra* is not likely to be confused in the field with any other species. The typical form is represented at the Garden by colonies under P. I. Nos. 49505, 66784, 75159, and 77259. Its original home is China; it was introduced into Japan at an early, apparently unrecorded date.

*P. nigra* is a favorite garden ornamental in China and Japan, and those who have seen it in Western gardens are charmed by the graceful habit of the plant and by the sharp accent of color provided by the culms in a suitable setting. The wood is hard enough for substantial cabinet work and it is very cleverly used by oriental cabinet makers for decorative panels and inlays, as well as for interior finish. Freeman-Mitford (2) (writing in English) says: "All sun-worshippers, who

wing their flight southward with the swallows, know the Black Bamboo as one of the chief ornaments which grace the gardens of the Riviera."

Culms of the typical form of the species (under P. I. Nos. 49505, 66784, and 77259) were included in studies on seasoning and physical properties carried out at the Clemson Agricultural College of South Carolina (3).

Shoot initiation begins at late mid-season.

The Black bamboo is somewhat widely, but very sparsely distributed in cultivation in the United States; it is offered by at least five nurseries (11). Its minimum temperature tolerance is estimated at  $0^{\circ}$  F.<sup>13</sup> It appears to be hardy at Glenn Dale, Md., and in Washington, D. C., but is slow in attaining its maximum height at this latitude.

#### *Phyllostachys nigra* (Lodd.)

Munro cv. BORY McClure, Arnold Arboretum Jour. 37: 195. 1956.

Unmon-Chiku (Japanese).

*P. boryana* Mitf., Garden 47: 3. 1895.

*P. puberula* var. *boryana* Makino, Bot. Mag. Tokyo 14: 64. 1900.

*P. nigra henonis* forma *boryana* Makino, Bot. Mag. Tokyo 28: 26. 1912.

The Bory bamboo differs from the typical form in the larger ultimate size and more erect habit of its culms and in the development of a few, scattered purplish to brown spots, instead of the black spots that ultimately more or less completely cover the lower internodes in the typical form.

The Bory bamboo is represented at the Garden by plants received from Gaston Negre, Generargues, France, in 1928, and accessioned as P. I. No. 77258. It probably is of Chinese origin, but satisfactory documentation of this has not been found.

Shoot initiation begins late.

<sup>13</sup> Data from files of Plant Introduction Section.

Bory bamboo is extremely limited in distribution in the United States; apparently it has not been listed by any nursery in recent years. Its minimum temperature tolerance is unknown, but it probably is not far from 0° F. under otherwise favorable conditions.

**Phyllostachys nigra** (Lodd.)

Munro cv. HENON McClure,  
Arnold Arboretum Jour. 37:  
194. 1956.

Ha-Chiku (Japanese).

*Bambusa puberula* Miq., Mus. Bot.  
Lugd. Batav. Ann. III, 2: 285.  
1866.

*Phyllostachys puberula* (Miq.)  
Munro, Gard. Chron. (n. s.) 6:  
773. 1876.

*P. henonis* Mitf., Garden 47: 3.  
1895.

*P. nigra* var. *henonis* (Mitf.) Stapf  
ex. Rendle, Linn. Soc. Bot.  
Jour. 36: 443. 1904.

The Henon bamboo differs from the black-stemmed typical form in the lack of color markings on the green internodes of its culms and branches. It is larger in ultimate stature, but apparently does not differ from the typical form by any character of a strictly morphological nature.

This bamboo is native to southern China, whence it was introduced into Japan at an early, apparently unrecorded date.

The original colony is growing at the Garden under P. I. No. 24761. This introduction was received from the Yokohama Nursery Co., Yokohama, Japan, in 1909. The Henon bamboo is also represented at the Garden by the following introductions: P. I. 66787 from plants growing wild in Kwangtung Province, China, and sent in by the writer in 1926; P. I. No. 75158 from Royal Botanic Gardens, Kew, England, 1927.

Freeman-Mitford (2, p. 151) sums up his estimate of this bamboo in these words: “\* \* \* this is in my eyes the most beautiful member of a beautiful family \* \* \* It is to its habit that

*Phyllostachys Henonis* owes its surpassing loveliness. The two-year-old culms, burthened with the weight of their own leaves clustering in triplets and borne upon innumerable branchlets, bend almost to the earth in graceful curves, forming a groundwork of most elegant beauty, from which the stems of the year spring up in slight zigzag, arching over at the top and waving their feathery fronds, the delicate green leaves seeming to float in the air. It must be from this quality that it derives its Japanese name HA-CHIKU, the two Chinese characters with which it is written signifying ‘light or volatile bamboo.’”

Mitford’s description was based on 4-year-old plants that were only 8 feet tall. Those who have had a glimpse of it in a fully developed state will remember the Henon bamboo as a giant with an appearance quite different from that portrayed by Mitford. A thriving clump well past its juvenile stage will show its culms strictly upright in habit, 20 to 50 ft. or more in height and 2 to 3 inches or more in diameter, with the lower one-half or two-thirds of the height free of branches. Looking upward from within the clump, one sees a canopy of green foliage supported on innumerable slender pillars. Young culms are rough to the touch, until the short stiff hairs fall away from the surface; freshly divested of their protecting sheaths they show a surface bright green, perceptibly dimmed by a thin film of white powder. In age, the powder, now offwhite, all but obscures the original green, or where sun and rain beat upon the culms and swaying leafy branches sweep their surfaces, a rich lustrous golden hue may be revealed.

As compared with mature culms, the young shoots are quite distinctive and infinitely more spectacular in their appearance, which they derive principally from the enveloping sheaths. The sheaths are an unspotted tawny hue, tinted with wine, and softened by an inconspicuous coat of spreading brown

hairs. The sheath blade stands at the top, flanked at its base by a pair of well-developed dusky auricles fringed with lavender bristles. Pressed against the culm or slightly spreading, the durable and persistent sheath blade suggests a bright, krislike (wavy) dagger. As its functions are completed, each sheath, in turn, takes on a light-tan color, beginning along the upper margins as the tissues dry. Presently it falls to the ground, revealing its polished inner surface and leaving behind the fresh and spotless green internodes of the young culm.

The hardness of the Henon bamboo impressed Mitford, who says "droughty summers have not been able to parch it, ice-bound winters have failed to starve it; and now, in the month of January, 1896, it is as green as in mid-summer."

Shoot initiation begins late. The fact that the new growth begins so late in the season allows it generally to escape damage from cold. The edible shoots have a considerable amount of acidity, or "bite," in the raw state and must be parboiled in at least two changes of well-salted water. However, they give off an agreeable fragrance during and after cooking (13).

Culms of Henon bamboo (under P. I. No. 24761) were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

Although the results of trials made in this country are incomplete and still inconclusive, it seems likely that this cultivar will prove to be among the hardiest of the phyllostachids. It is hardy at Glenn Dale, Md., and its minimum temperature tolerance has been estimated at  $-4^{\circ}$  F.<sup>14</sup> This bamboo has been rather widely distributed for trial and is listed by at least three nurseries (11).

During World War II culms of this bamboo were subjected to comparative

tests, along with 11 other species representing 4 distinct genera, as material for making laminated (hexagonal) ski poles. The following is quoted from the report on these tests (6): "In pound-resistance and fracture characteristics, this bamboo showed performance under test somewhat superior to that of *Ph. bambusoides*. In manufacture, the prominence of the nodes is sufficient to involve some weakening of the 'enamel' when the nodes are sanded."

*Phyllostachys nuda* McClure, Wash.  
Acad. Sci. Jour. 35: 288. 1945.  
(Figs. 36 and 37.)

Culms up to 25 ft. tall and  $1\frac{1}{4}$  in. in diameter at the base; internodes



P. I. S. NEG. 87689

FIGURE 36.—*Phyllostachys nuda* (P. I. No. 103938): Young shoots near Glenn Dale, Md.

<sup>14</sup> Data from files of Plant Introduction Section.

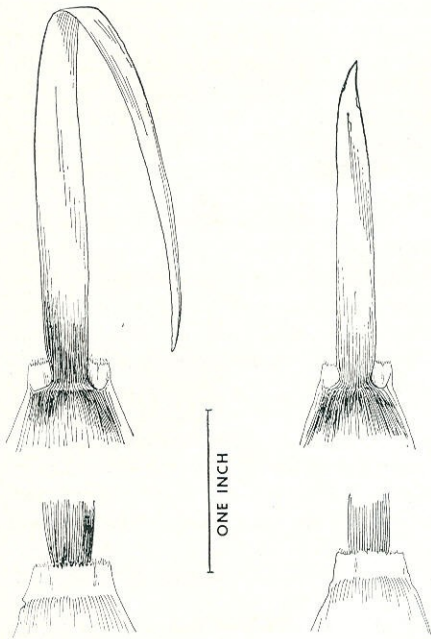


FIGURE 37.—*Phyllostachys nuda* (P. I. No. 103938): Outer (above) and inner (below) aspects of the apex of culm sheaths.

(No. 1: 2 in. long; No. 5:  $6\frac{1}{4}$  in. long; No. 13—the longest in a culm 16 ft. long, with 44 internodes— $7\frac{1}{2}$  in. long) green, copiously and loosely farinose at sheath-fall, entirely glabrous, perceptibly ribbed-striate; nodal ridges rather prominent, the lower ones tinted with wine at first; sheath scars about as prominent as the nodal ridges, entirely glabrous; culm sheaths grayish wine, farinose, scabrous but not pubescent, the margins glabrous, basal ones blotched with wine, the upper ones immaculate; auricles and oral setae lacking; ligules strongly exserted, the apex truncate, the margin ciliate; sheath blades relatively short, narrowly triangular to lance-shaped, crinkled, spreading away from the culm; leaf sheaths without auricles and oral setae; ligules prominently exserted, the apex strongly convex, the margin minutely ciliate at first; leaf blades up to 6 in. long and  $\frac{7}{8}$  in. broad, commonly 3 to 4 in. long and  $\frac{3}{8}$  to  $\frac{1}{2}$  in. broad, antrorsely sca-

brous throughout and sparsely hirsute basally on the lower surface.

“Nuda” alludes to the absence of auricles and oral setae in both culm sheath and leaf sheath.

*P. nuda* is perhaps most apt to be confused with *P. arcana*, from which it may be distinguished readily by the truncate ligule of its culm sheath.

*P. nuda* is native to Tang-si, Chekiang Province, China, whence it was introduced by Frank N. Meyer in 1908. It is growing at the Garden under P. I. No. 103938.

A large and flourishing colony of this bamboo is under cultivation in the garden at the residence of George M. Darrow, near the Plant Introduction Garden at Glenn Dale, Md. The culms have been variously employed by Dr. Darrow about the premises for temporary structures such as arbors, trellises, fences, and garden stakes, while the shoots harvested to hold the colony in check find a welcome place in the family menu. The shoots of this bamboo, when small (4 to 6 inches long) are only slightly acid and among the best known to the writer. This species appears to be very hardy, the plants at the Darrow place having been seriously injured by cold only a few times during the last 25 years. Its minimum temperature tolerance is probably a little below  $0^{\circ}$  F. under otherwise favorable conditions.

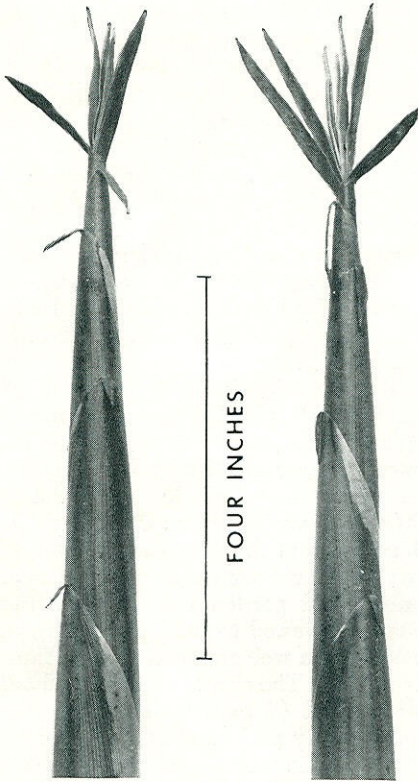
Culms of this bamboo were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

*P. nuda* is still very limited in its distribution and apparently has not been listed by any nursery.

***Phyllostachys propinqua* McClure,**  
Wash. Acad. Sci. Jour. 35: 289.  
1945.

(Figs. 38 and 39.)

Culms up to 23 ft. 4 in. tall and  $1\frac{1}{4}$  in. in diameter; internodes (No. 1:  $2\frac{3}{4}$  in. long; No. 5:  $6\frac{3}{4}$  in. long; No. 11—the longest in a culm 23 ft. 4 in. long, with 46 internodes— $10\frac{1}{4}$  in. long)



P. I. S. NEG. 37367

FIGURE 38.—*Phyllostachys propinqua* (P. I. No. 76649): Young shoots from the Garden.

green, faintly glaucous at sheath-fall, entirely glabrous, not ribbed-striate; nodal ridges moderately prominent; sheath scars about as prominent as the nodal ridges, thin, glabrous; culm sheaths pale olive with green veins, lustrous with a bronzy sheen, sparsely covered with small brown spots, entirely glabrous, even on the margins; auricles and oral setae lacking; ligules weakly developed, the apex convex, with a hump in the middle, the margin glabrous or weakly ciliolate; sheath blades green with a very narrow white border, all tinted with wine, lance-shaped to ribbon-shaped, reflexed, not crinkled or only slightly so; leaf sheaths with auricles and oral setae of variable occurrence and development, often lacking;

ligules strongly exerted, the apex strongly convex, the margin irregular, minutely ciliolate; leaf blades rarely up to  $7\frac{1}{2} \times 1\frac{1}{16}$  in., commonly 3 to 5 in. long and  $\frac{7}{16}$  to  $\frac{5}{8}$  in. broad, usually more or less perceptibly scabrous, especially toward the base, on the lower surface.

This species is most apt to be confused with *P. meyeri* from which it may be distinguished by the absence of the narrow line of white hairs that is always found along the base of the culm sheath and on the sheath scar of *P. meyeri*.

Propagating material of *P. propinqua* was obtained by the writer in 1928 from the wilds along the West River, near Wuchow, Kwangsi Province, China. It is represented at the Garden by P. I. No. 76649.

Shoot initiation begins at late mid-season.

Culms of this bamboo were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

*P. propinqua* apparently is practically unknown in cultivation outside the Garden, and the flavor qualities of the shoots have not been studied.

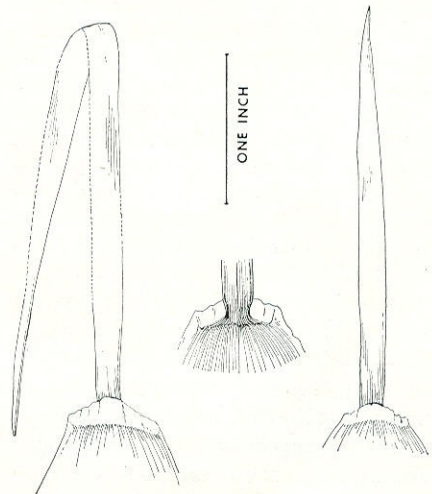


FIGURE 39.—*Phyllostachys propinqua* (P. I. No. 76649): Outer (center) and inner aspects of the apex of culm sheaths.

***Phyllostachys pubescens*** Mazel ex.

H. de Leh., *Bambou*, p. 7.  
1906; McClure, *Arnold Arboretum Jour.* 37: 189. 1956.  
Moso-Chiku (Japanese).

(Figs. 40 and 41.)

*P. edulis* H. de Leh., *Bambou*, p. 39. 1906.

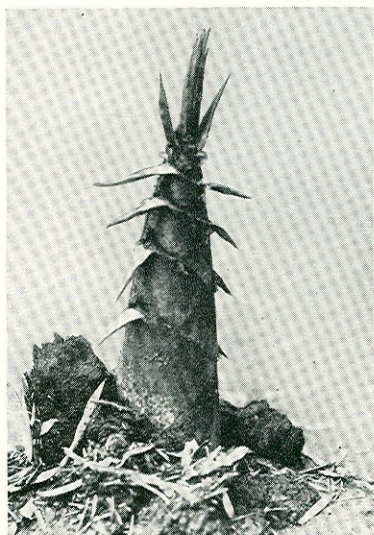
*P. mitis* of Japanese authors writing at the turn of the century.

Culms up to 38 ft.  $8\frac{1}{2}$  in. tall and 4 in. in diameter at the base in plants growing at the Garden (elsewhere in the Southern States attaining heights up to 70 ft. with commensurate diameter), strongly tapered, straight and erect or more commonly more or less curved, suberect and broadly arched at the tip, often emerging from the ground perceptibly off perpendicular, then curving upward to become erect or nearly so; internodes (No. 1: 2 in. long; No. 5: nearly 4 in. long; No. 26—the longest in a culm 38 ft.  $8\frac{1}{2}$  in. long, with 63 internodes—12 in. long) pale green, densely velvety throughout at first, gradually glabrescent, sometimes perceptibly ribbed, sometimes floccose-

farinose at first and gray at length with accumulated waxlike powdery exudate; nodal ridges nearly obsolete at unbranched nodes; sheath scars marked at first by a prominent fringe of brown hairs, not prominently flared; culm sheaths greenish-smoky buff, densely maculate with dark brown, abundantly glaucous, densely strewn throughout with brown erect hairs, densely ciliate on the margins; auricles strongly developed, falcate, dark purplish to brown, fringed with numerous coarse, very long, wavy oral setae; ligules long, exerted, narrowly convex at the apex, lacinate and fringed on the margin with long, coarse, dark, scabrous bristles; sheath blades lance-shaped to narrowly triangular to nearly strap-shaped, rather stiff, green, the lower ones often somewhat wavy, appressed to the culm, the upper ones spreading away from it more or less strongly; leaf sheaths with auricles and oral setae usually lacking or the oral setae rarely 2 or 3, small, weak; ligules very short, scarcely exerted; leaf blades up to 5 in.  $\times \frac{5}{8}$  in., more commonly 2 or 3 inches long and  $\frac{3}{8}$  to  $\frac{1}{2}$  in. broad, glabrous or nearly so except at the very base on the lower surface.

The combination of unusually small leaves, velvety culm internodes, strongly tapered culms, and relatively short lower internodes sets this bamboo off very effectively from all other known members of the genus.

Native to the warm temperate parts of China, where it is known as Mo Chu (Hairy Bamboo) and Mau Chu (Lance Bamboo), *P. pubescens* was introduced into Japan via the Ryukyu Islands about 1738. From Japan it reached Europe about 1880, and about 10 years later a successful introduction was accomplished by an importer on the west coast of the United States. From a plant of this introduction several colonies were subsequently developed in Anderson, S. C., by Rufus Fant. In 1926 Mr. Fant presented rhizomes from one of these plantings to the United States Department of Agricul-



P. I. S. NEG. 43562

FIGURE 40.—*Phyllostachys pubescens* (P. I. No. 80034): Young shoot, Komazawa, Tokyo, Japan.

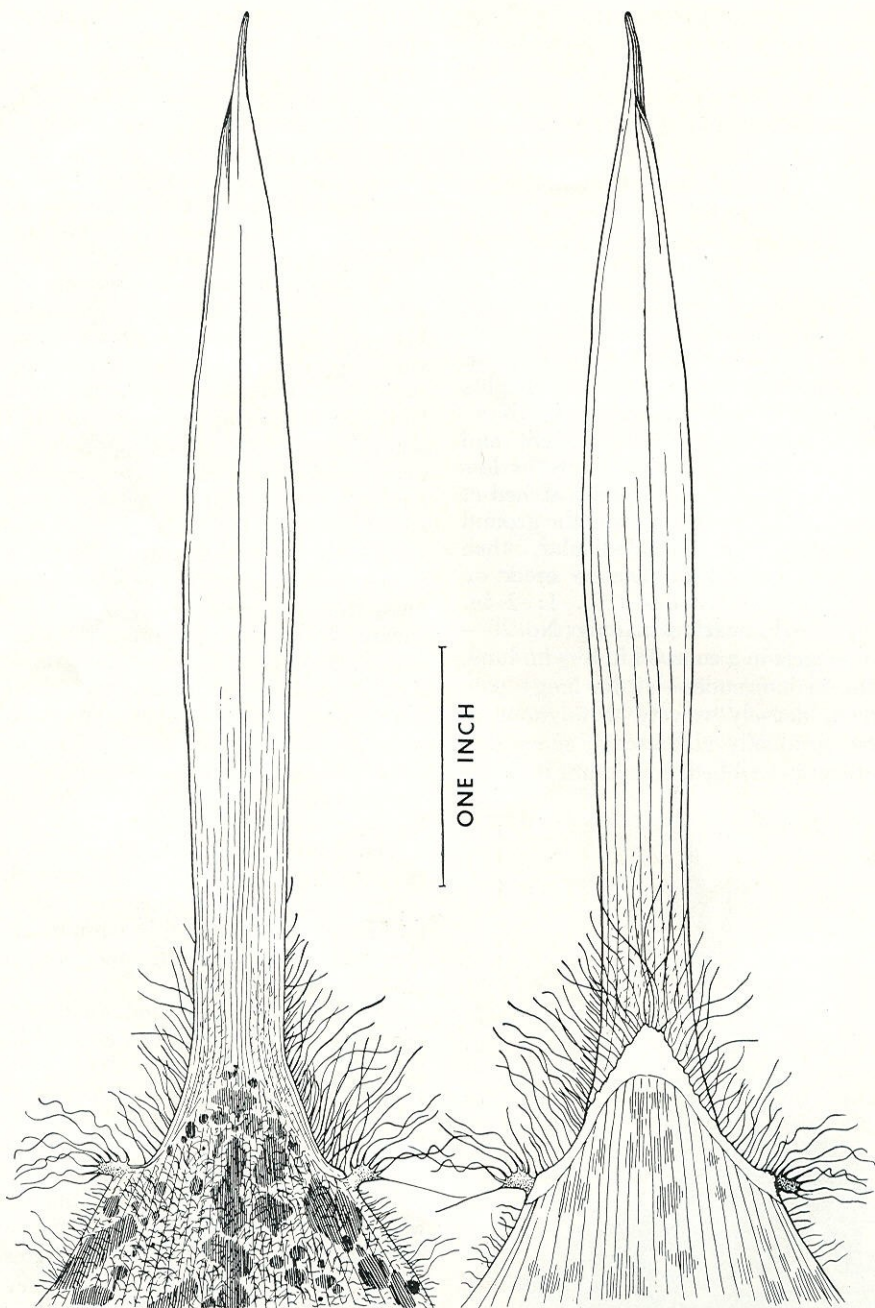


FIGURE 41.—*Phyllostachys pubescens* (P. I. No. 80034): Outer (left) and inner (right) aspects of the apex of the culm sheath, showing sheath blade, ligule, and auricles.



ture and a colony was established at the Garden under P. I. No. 80034.

*P. pubescens* is a plant of consummate beauty. The great, broadly arched culms heavily burdened with masses of tiny leaves suggest giant pale-green ostrich plumes. It is difficult to propagate and rather exacting in its cultural requirements. Though the wood is relatively soft in texture, the culms are much used in the Orient and are perhaps second only to *P. bambusoides* in their versatility. *P. pubescens* is used for heavy construction, cables, well-drilling equipment, tubing for piping salt brine, water, and gas, children's toys, mah-jongg tiles, and tobacco pipes (dwarfed culms). The rhizomes are commonly used to make walking sticks and umbrella handles.

Shoot initiation begins early to early midseason. The young shoots are edible; "winter shoots" in a dormant state, dug before they have pierced the surface of the soil, are an oriental delicacy that sells at a premium during the offseason winter months when they are the only fresh shoots available. In the raw state they have a considerable degree of acidity, which must be removed by boiling in two waters. However, the shoots give off an agreeable fragrance during and after cooking (13).

Culms of this bamboo were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

The minimum temperature tolerance of *P. pubescens* has been estimated at 3° F.<sup>15</sup> In spite of its great value and popular appeal, this species is still very limited in its distribution, owing primarily to the difficulty of propagation and of getting the plants established. It is listed by at least one nursery (11).

The so-called Tortoise-shell bamboo, a bizarre form of this species, has attracted much attention and interest in

China and Japan since early times. As much perhaps because of its extreme rarity as because of its physical peculiarities, it has been given numerous fanciful names, of which "Kikko-Chiku" is widely current in Japan and "Lohan Chu" in China.

This curiosity occurs only in the midst of a grove of normal culms and makes its appearance as isolated culms, the lower part of which is characterized by oblique nodes and asymmetrically shortened internodes with a bulge on one side and a hollow on the other. Above this abnormal part, which is usually several feet long and unbranched, the internodes revert to their normal expression.

In the Orient these abnormal culms are always collected for decorative or magical purposes. In the dried state they often become objects of veneration and are enshrined behind an incense bowl. In the living condition they are often transplanted to gardens where, with proper care, they may remain an ornament for many years. They do not reproduce themselves, however.

A living example of this curious form was obtained from the Yokohama Nursery Co. by the United States Department of Agriculture in 1931. The plant was accessioned as P. I. No. 93224 with the name "*Phyllostachys edulis heterocycla*." It remained alive under cultivation at the Garden until some time during the early 1940's, when it finally died after a period of decline lasting several years.

***Phyllostachys purpurata* McClure,**  
Lingnan Univ. Sci. B. 9: 43.  
1940.

(Figs. 42 and 43.)

Culms up to 18 ft. 4 in. tall and  $\frac{3}{4}$  in. in diameter at the base (about the same in cv. Solidstem, and up to 33 ft. 4 in. tall and  $1\frac{1}{2}$  in. in diameter at the base in cv. Straightstem) weak, arched broadly to one side and strongly flexuose (zigzag), more espe-

<sup>15</sup> Data from files of Plant Introduction Section.

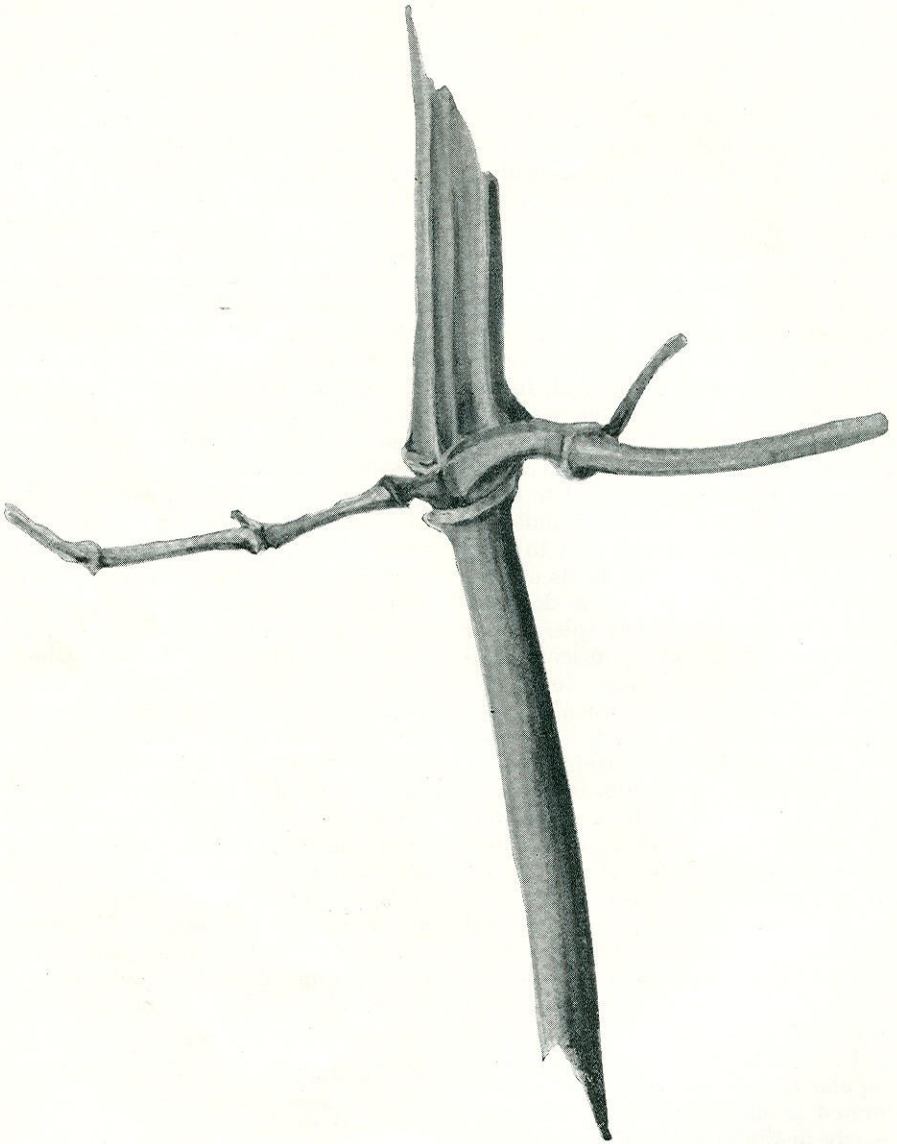


FIGURE 42.—*Phyllostachys purpurata*, typical form (P. I. No. 128771): Brush drawing by Chinese artist Li T'ang, showing typical branch complement and characteristics of the node and adjacent internodes.

cially in the branched portion (stiff and strictly erect in cv. Straightstem); internodes (No. 1:  $2\frac{1}{8}$  in. long; No. 5:  $6\frac{3}{4}$  in. long; No. 18—the longest in a culm of cv. Straightstem 25 ft. 6 in. long, with 41 internodes— $14\frac{1}{4}$  in. long) green, glaucous, glabrous or

(especially 2 or 3 of the basal ones) weakly pilose, hollow (in cv. Solidstem not hollow in the basal  $\frac{1}{2}$  to  $\frac{2}{3}$  of the culm); nodal ridges narrow, rather prominent (much less so in the cvs. Straightstem and Solidstem); sheath scars glabrous, moderately thick and

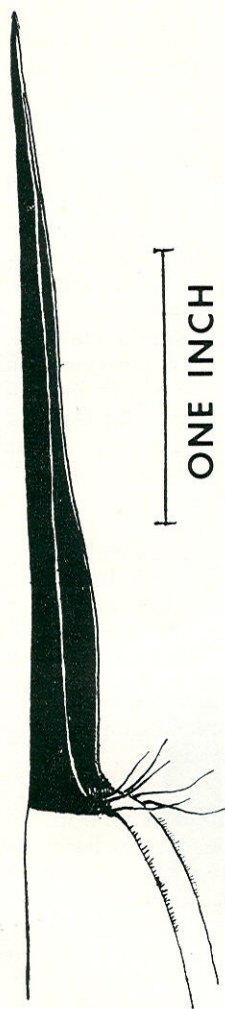


FIGURE 43.—*Phyllostachys purpurata*, typical form (P. I. No. 128771): Apex of culm sheath, the purple sheath blade shown in black.

slightly flared; culm sheaths glabrous, green or more or less stained with wine, not spotted, often glaucous, especially near the base; auricles weakly developed, purplish; oral setae few, weak or lacking; ligules short, weakly convex at the apex, ciliolate or fringed with weak bristles on the margin; sheath blades broad to narrow, triangular, boat-shaped, appressed to the culm, often somewhat wavy, characteristically

tinted with purple throughout (green or nearly so in cvs. Straightstem and Solidstem); leaf sheaths usually lacking auricles and oral setae; ligules very short, scarcely exerted; leaf blades commonly 2 to 3 in. long and  $\frac{3}{8}$  to  $\frac{1}{2}$  in. broad, glabrous or nearly so on the lower surface.

From the general similarity of the culm sheaths, the several forms of this species are most apt to be confused with *P. congesta*, from which they may be distinguished by their weaker, less strongly tapered culms with longer internodes and the more prominent development of the auricles and oral setae on the culm sheaths.

The typical form is represented at the Garden by P. I. No. 128771 (from the type plant) which originated at Koon-t'aan-haang, Kwangning District, Kwangtung Province, China. Propagating material was sent in by the writer in 1938.

The typical form of *P. purpurata* is characterized by slender, more or less strongly zigzag culms with rather long internodes alternately twisted in opposite directions. The culms, prominently glaucous at sheath-fall, are relatively weak (not stiff), with conspicuously large nodes bearing subhorizontal branches. Under favorable conditions the culms may reach a height of 18 ft. and a diameter of  $\frac{3}{4}$  in. The young shoots present a striking and characteristic appearance, the pale glaucous-green culm sheaths providing a pleasing foil for the dark purplish-wine, narrowly triangular, appressed sheath blades. The culm sheaths have the auricles and oral setae usually weakly developed, sometimes almost wholly lacking.

Shoot initiation begins at midseason. The flavor qualities of the typical form of the species have not been investigated.

*P. purpurata* and its forms are extremely rare in cultivation in the United States; apparently none of them has been listed by any nursery.

**Phyllostachys purpurata** McClure  
cv. SOLIDSTEM (new cultivar).

Solidstem bamboo is distinguished from the typical form of *P. purpurata* by culms with the lower one-half or more entirely solid and a mature stature roughly one-half to two-thirds as great. As in the typical form of the species, isolated culms are frequently bent to the ground by a stiff wind or by the weight of the foliage, especially when it is wet.

Propagating material of the type plant (P. I. No. 77006) was sent in by the writer in 1920 from Chiu-hwa-shan, Anhwei Province, China. Subsequent accessions of this form obtained by the writer in China (1938) are the following: P. I. No. 128791, from Lung-chi Mountain, Kiangsu Province; P. I. Nos. 128800 and 128805 from Mo-hong, Chekiang Province. All are to be found growing at the Garden.

Shoot initiation begins at midseason. In the raw state the shoots have a very slight degree of acidity, or "bite" (13).

Culms of this bamboo (under P. I. No. 77006) were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

This form of the species has proved to be very satisfactory as a hedge plant (4). The straight, solid culms supply scores of needs about the home and garden.

**Phyllostachys purpurata** McClure  
cv. STRAIGHTSTEM (new cultivar).

(Figs. 44 and 45.)

Straightstem differs from the typical form of *P. purpurata* in attaining a larger stature, with culms exceeding 30 ft. in height and 1½ in. in diameter, and in being stiffer and more erect, with the unbranched nodes less prominent. Its culm sheath blades are less strongly tinted with wine. This color,

being more generally diffused throughout the sheath, never completely obscures the green in the sheath blade as it often does in the typical form of the species.

Propagating material of P. I. No. 77001, type plant, was sent by the writer from Tai-hoh-hau, Anhwei Province, China, in 1927. P. I. No. 116711, included in the same shipment, was obtained at Chiu-hwa-shan, in the same province. P. I. No. 128792 from Lung-chi Mountain and 128797 from I-hing, Kiangsu Province, China, were sent in by the writer in 1938. These are all growing at the Garden.

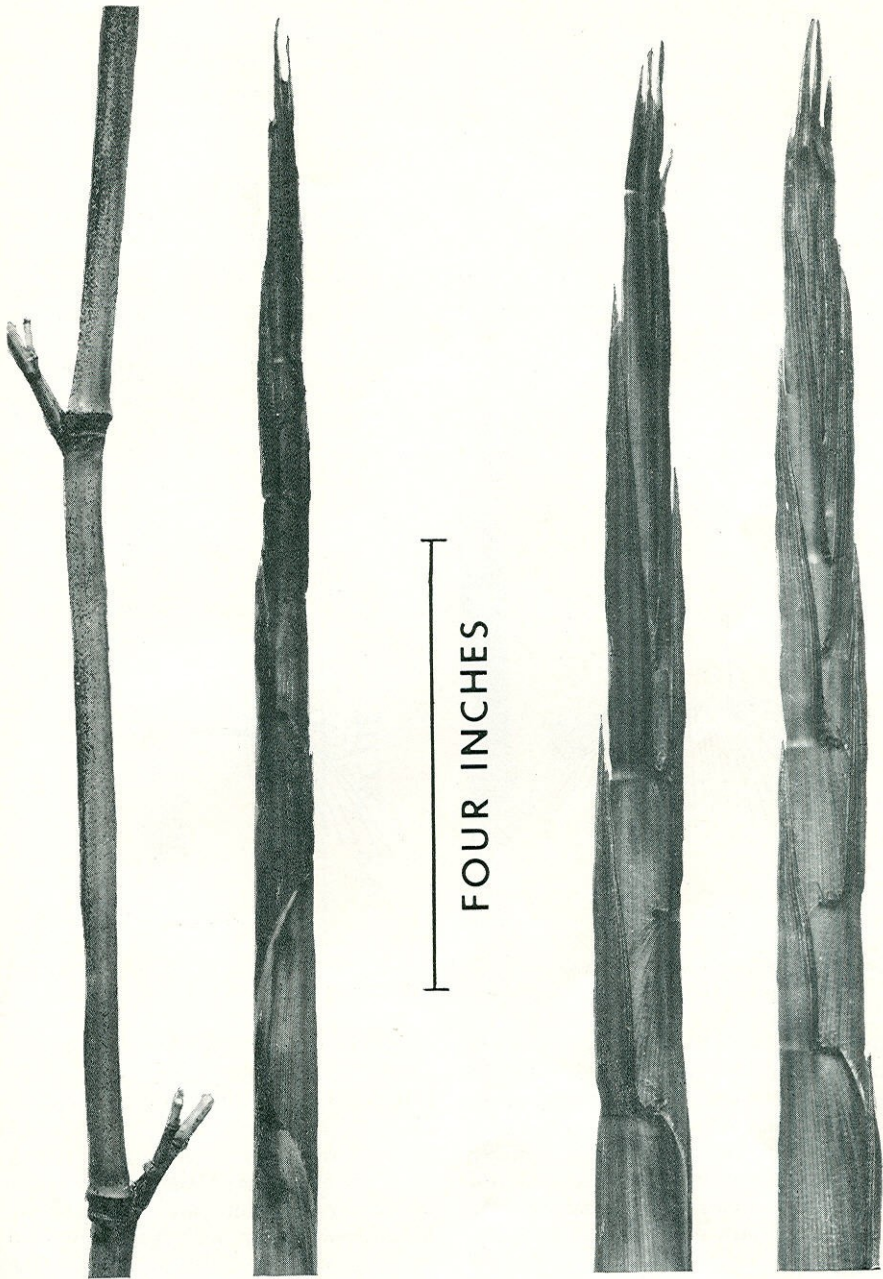
Shoot initiation begins at midseason. The flavor qualities of the shoots of Straightstem have not been investigated.

Culms of this bamboo (under P. I. No. 116711) were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

**Phyllostachys rubromarginata** McClure, Lingnan Univ. Sci. B. 9:  
44. 1940.

(Figs. 46 and 47.)

Culms up to 31 ft. 6 in. tall and 1¼ in. in diameter at the base, erect, nearly straight to rather strongly curved throughout; internodes (No. 1: 4¾ in. long; No. 5: 12⅝ in. long; No. 10—the longest in a culm 31 ft. 6 in. long, with 41 internodes—15¾ in. long) pale green and not conspicuously glaucous at sheath-fall, gradually and imperceptibly becoming coated with wax, then gray to yellowish gray in age, in slender culms glabrous, in larger ones sparsely strewn with minute, retrorse, white bristles barely perceptible to the touch and almost invisible to the naked eye, later glabrescent, cylindrical or nearly so above unbranched (budless) nodes in small culms but often somewhat asymmetrically bulging and curved in large culms; nodal ridges narrow, only slightly elevated; sheath



P. I. S. NEGS. 37345, 37346

FIGURE 44.—*Phyllostachys purpurata* cv. Straightstem (P. I. No. 116711): Small culm and young shoots from the Garden.

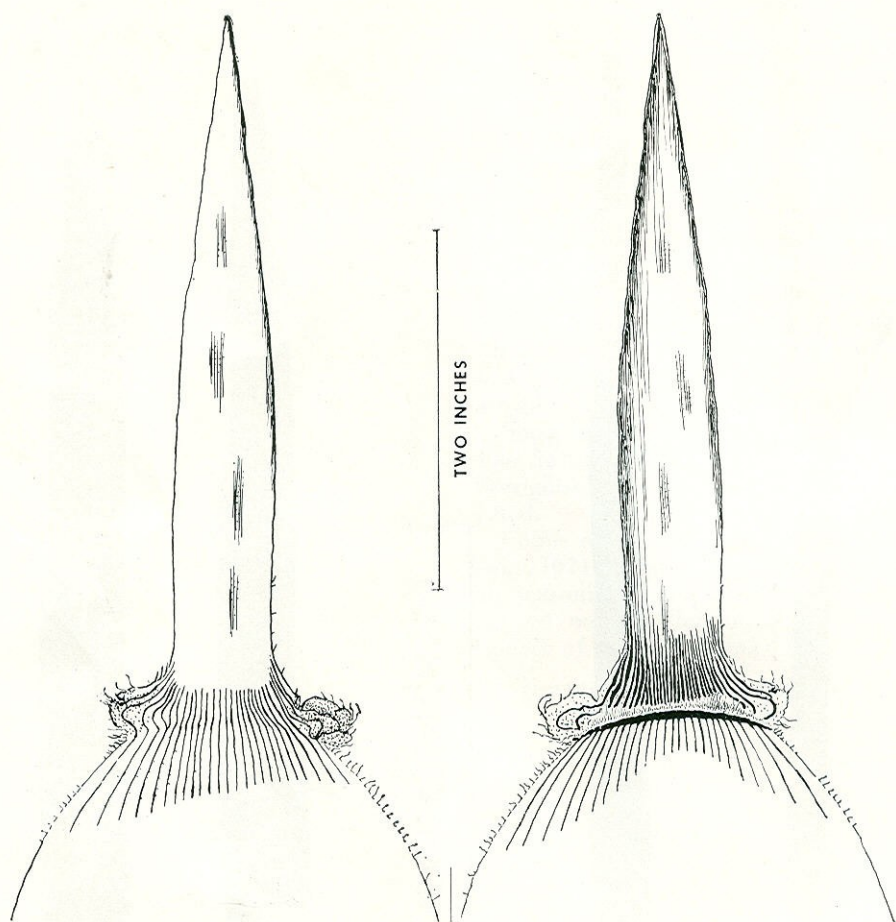
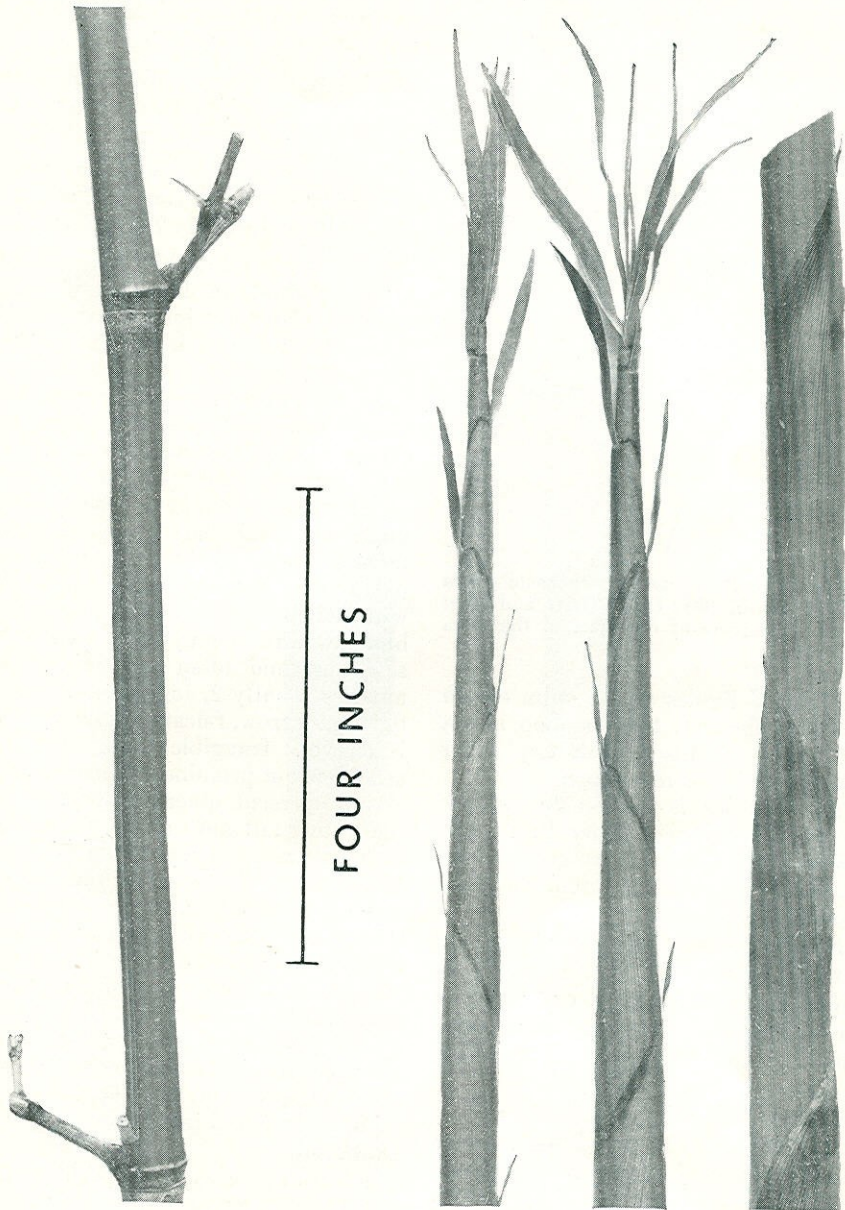


FIGURE 45.—*Phyllostachys purpurata* cv. Straightstem (P. I. No. 116711): Outer (left) and inner (right) aspects of the culm sheath, showing sheath blade, ligule, and auricles.

scars sharp, clean, glabrous, not much flared; culm sheaths olive green to buff, often more or less striped or stained on the back and bordered on the upper margins with red, not spotted, entirely glabrous on the back and margins, not glaucous; auricles and oral setae none; ligules very dark red when fresh, short, truncate or slightly concave, and often more or less asymmetrical at the apex, white ciliolate on the margin and backed with red, scabrous bristles, the middle ones longest; sheath blades narrowly triangular to ribbon-shaped, appressed in lower sheaths, spreading

more or less broadly away from the culms in upper ones, not at all crinkled; leaf sheath with small auricles fringed with oral setae; ligules exerted, fringed on the margin with long, dark red cilia; leaf blades rather large, up to  $6\frac{1}{2}$  in. long and nearly 1 in. broad, commonly 4 or 5 in. long and  $\frac{3}{8}$  to  $\frac{3}{4}$  in. broad, scabrous along the midrib on the upper surface, sparsely pilose to glabrous on the lower surface.

Owing to the combination of characters (long slender culm internodes, unspotted and unstriped culm, sheaths lacking auricles and oral setae, and the



P. I. S. NEGS. 37365, 37366

FIGURE 46.—*Phyllostachys rubromarginata* (P. I. No. 77000) : Culm and young shoots from the Garden.

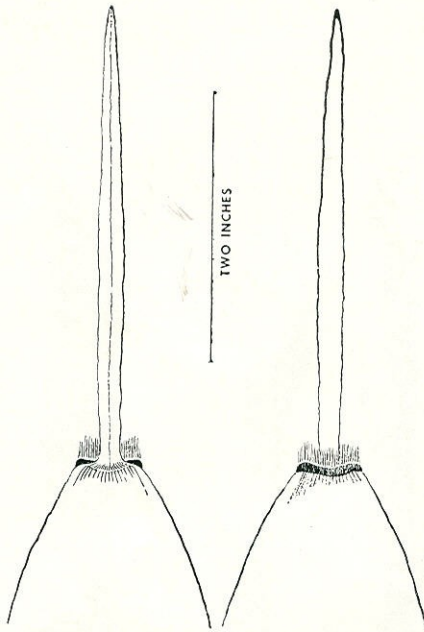


FIGURE 47.—*Phyllostachys rubromarginata* (P. I. No. 67398): Outer (left) and inner (right) aspects of the apex of the culm sheath.

red-fringed ligules of the culm sheath and leaf sheath), this bamboo is not apt to be confused with any other known species of the genus.

This species is represented at the Garden by colonies under P. I. Nos. 66902, 67398, and 77000, all obtained by the writer from different localities in southern China.

Shoot initiation begins late in the season. The shoots (13) have a very slight degree of acidity, or "bite," in the raw state. This species is cultivated in China principally for its edible shoots.

Culms of this bamboo (under P. I. No. 67398) were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

The culms are useful for a number of purposes, including garden stakes, material for basketry, and shepherds' pipes. The culm sheaths make satis-

factory covers for the block-print maker's baren (8).

This bamboo is still very limited in its distribution; apparently it is not listed by any nursery.

***Phyllostachys viridi-glaucescens***  
(Carr.) A. & C. Riv., Soc. Acclim. B. Ser. 3, 5: 700. 1878.  
(Figs. 48 and 49.)

*Bambusa viridi-glaucescens* Carr.,  
Rev. Hort. 41: 293. 1869.

Culms up to 34 ft. 8 in. tall and 2 in. in diameter at the base, straight and erect or nearly so; internodes (No. 1: 2 in. long; No. 5: 6 in. long; No. 18—the longest in a culm 34 ft. 8 in. long, with 57 internodes—15¼ in. long) green, copiously but sometimes unevenly and loosely farinose at sheath-fall, entirely glabrous, not ribbed; nodal ridges prominent; sheath scars glabrous, weakly flared, about as prominent as the nodal ridges; culm sheaths pale buff, tinged with green and strewn with small brown spots and small blotches throughout, loosely farinose, scabrous, and often sparsely setose; auricles usually 2, sometimes 1, rarely 0, long, narrow, falcate, dark wine, delicate, very frangible when dry; oral setae few but prominent when the auricles are present, otherwise lacking; ligules rather tall and narrow, often asymmetrical, more or less strongly convex at the apex, the margin more or less regular to lacinate, finely to coarsely ciliate, at length smooth; sheath blades narrow, ribbon-shaped, reflexed, usually more or less strongly crinkled; leaf sheaths with auricles and oral setae usually developed, fugacious; ligules exserted, soon split and mutilated; leaf blades 1⅝ × ¼ in. to 7⅝ × 1 in., more commonly 4 to 5 in. long and ½ to ¾ in. broad.

*P. viridi-glaucescens* is perhaps most apt to be confused with *P. elegans*, which differs in the relatively short, definitely ribbed-striate internodes of its culm and its much smaller, usually lance-shaped leaf blades that are pubescent on the lower surface.



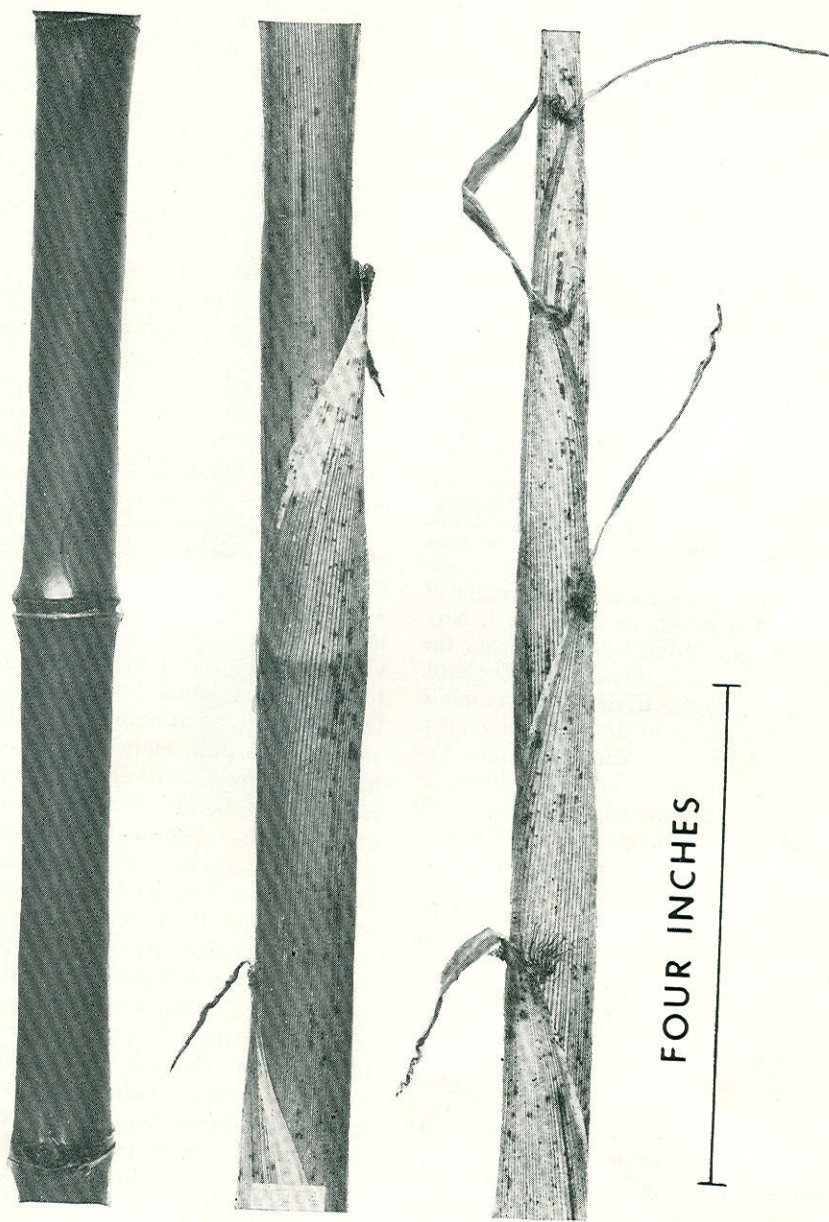


FIGURE 48.—*Phyllostachys viridi-glaucescens* (P. I. No. 75160) : Young culm and shoots from the Garden.

P. I. S. NEG. 37341

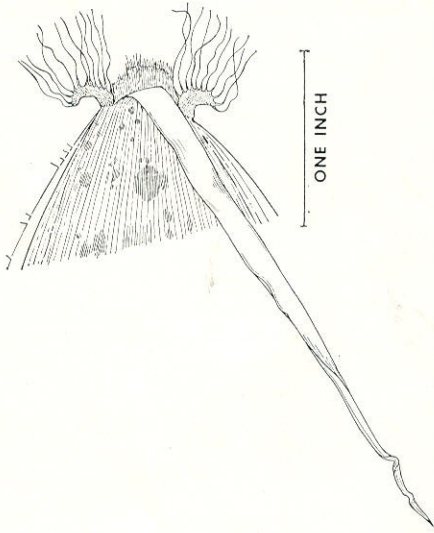


FIGURE 49.—*Phyllostachys viridi-glaucescens* (P. I. No. 75160): Apex of culm sheath, showing sheath blade, ligule, and auricles.

*P. viridi-glaucescens* is represented at the Garden by plants under P. I. Nos. 123432 and 75160 obtained from the Royal Botanic Gardens, Kew, England. According to the Rivières this bamboo reached France in 1846, having been imported by Vice-Admiral Count Cécille from its native home in China.

Shoot initiation begins early. The shoots have been found to have only a very slight degree of acidity, or "bite," in the raw state (13).

Culms of this bamboo were not included in the studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina, although the name *P. viridi-glaucescens* appears in table 1 (3) in connection with P. I. No. 128778, which is *P. elegans*.

Although this bamboo has very straight culms of excellent properties and is a very vigorous and hardy species, with an estimated minimum temperature tolerance of  $-4^{\circ}$  F.,<sup>16</sup> it is

<sup>16</sup> Data from files of Plant Introduction Section.

nowhere abundant in cultivation and apparently is not listed by any nursery.

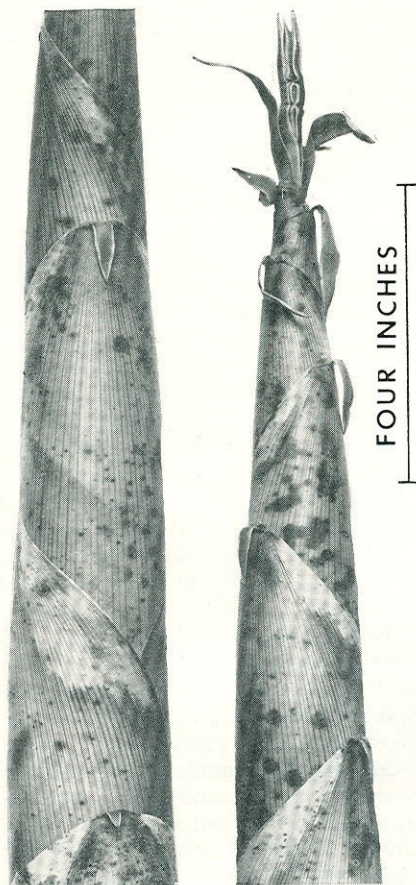
***Phyllostachys viridis*** (Young) McClure, Arnold Arboretum Jour. 37: 192. 1956.

(Figs. 50 and 51.)

*P. sulphurea* var. *viridis* R. A. Young, Wash. Acad. Sci. Jour. 37: 345. 1937.

*P. mitis* A. & C. Riv., Soc. Acclim. B. Ser. 3, 5: 689. 1878 (Description only, excl. syn.)

Culms up to 47 ft. 5 in. tall and  $3\frac{1}{4}$  in. in diameter at the base (smaller in cv. Robert Young), suberect, usually somewhat curved but not zigzag; internodes (No. 1:  $1\frac{3}{8}$  in. long; No. 5: 8 in. long; No. 22—the longest in a culm of the typical form 47 ft. 5 in. long, with 60 internodes—19 in. long) pale green (yellow, with green stripes in cv. Robert Young), glabrous, perceptibly glaucous, especially below the nodes, the surface not at all ribbed-striate but marked by minute indentations in a visible pigskinlike pattern perceptible to the touch; nodal ridges imperceptible or nearly so at unbranched nodes; sheath scars thin, glabrous, not at all flared, the nodes marked by a distinctively broad band of white powder; culm sheaths glabrous, often perceptibly glaucous, light rosy buff (paler in cv. Robert Young) the veins green, often darker than the background, which is conspicuously spotted with dilute smoky brown; auricles and oral setae obsolete; ligules truncate in small culms to strongly convex in large ones, the margin fringed with scabrous bristles in small culms, ciliolate to scabrous in large ones; sheath blades narrowly triangular to ribbon-shaped, more or less wavy, not or only slightly crinkled, usually spreading more or less strongly away from the culm, the lower ones usually completely reflexed; leaf sheaths with auricles and oral setae



P. I. S. NEG. 37337

FIGURE 50.—*Phyllostachys viridis*, typical form (P. I. No. 77257): Young shoots from the Garden.

usually well-developed on young culms, often lacking in older culms; ligules well-developed, exserted; leaf blades commonly 3 to 5 in. long and  $\frac{5}{8}$  to  $\frac{7}{8}$ , rarely 1 in., broad, sometimes pilose or scabrous on one side, otherwise glabrous or nearly so except at the base on the lower surface.

*P. viridis* apparently closely resembles *P. makinoi*, but the original description of the latter is incomplete in respect to critical characters, and plants of it at the Garden are still very im-

mature. From the other species of the genus the typical form of *P. viridis* is easily distinguishable by the following combination of characters: The glabrous, maculate culm sheaths lacking auricles and oral setae, the obsolete nodal ridges, the very inconspicuous sheath scar, the very broad farinose zone at each culm node, and the pig-skinlike surface of the culm internodes.

*P. viridis* is represented at the Garden by the original colony under P. I. No. 77257 developed from plants obtained in 1928 from Gaston Negre, Generargues, France.

Shoot initiation begins at midseason and continues longer than in most species of the genus. The shoots have been found to be free from any unpleasant taste or "bite" even in the raw state. When cooked they give off an agreeable fragrance (13).

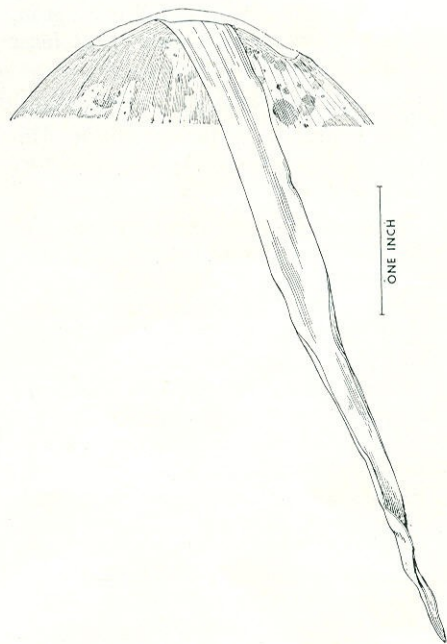


FIGURE 51.—*Phyllostachys viridis*, typical form (P. I. No. 77257): Apex of culm sheath, showing sheath blade and ligule.

This species is cultivated in China both for its highly esteemed edible shoots and for its culms, which have excellent technical properties.

During World War II culms of this bamboo were subjected to comparative tests, along with 11 other species representing 4 distinct genera, as material for making laminated (hexagonal) ski poles. The following is quoted from the report on these tests (6): "Its performance was well above the minimal requirements in all of the tests."

Culms of this bamboo (under the name *P. sulphurea viridis*) were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

*P. viridis* is still very limited in its distribution. Though it is slow to spread, it is rather hardy with an estimated minimum temperature tolerance of 0° F.<sup>17</sup> It is apparently quite hardy at Glenn Dale, Md., and Washington, D. C. It has been listed by at least two nurseries (II).

**Phyllostachys viridis** (Young) McClure cv. ROBERT YOUNG McClure, Arnold Arboretum Jour. 37: 195. 1956.

The Robert Young bamboo was identified by Houzeau de Lehaie (5, p. 99, and elsewhere) as *Phyllostachys sulphurea* A. & C. Riv., under which name it has appeared in the records of the Plant Introduction Section.

Robert Young bamboo differs from the typical form of the species in having a smaller mature stature and a distinctive coloration. The culms and branches are at first sulfur green with darker green stripes on the lower internodes, and a narrow dark-green band immediately below each sheath scar. Occasional leaf blades show cream stripes. The sulfur-green background

gradually turns to old gold and the green stripes persist. The culm sheaths are paler than those of the species and occasionally show a slender green stripe or two.

From the horticultural form Allgold of *P. bambusoides*, which it resembles somewhat in stature and general appearance, the Robert Young bamboo may be most readily distinguished by the pigskinlike surface of its internodes, a character it has in common with the typical form of the species.

The Robert Young bamboo is represented at the Garden by the original colony of P. I. No. 89718 developed from plants obtained in 1930 from V. N. Gauntlett & Co., Chiddingfold, Surrey, England. It also originated again (personal observation, May 1955) from propagules of *P. viridis* (P. I. No. 77257) in the nursery at the Garden.

Shoot initiation begins at midseason. The flavor qualities of the shoots have not been studied, but may be assumed to differ little, if any, from those of the shoots of the typical form.

Culms of this bamboo were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

Like the typical form of the species, the Robert Young bamboo spreads slowly. Its minimum temperature tolerance is estimated at 5° F.<sup>18</sup> It is rare in cultivation, but it has been listed by one nursery as *P. sulphurea*.

Robert A. Young, in whose honor this bamboo is named, is known through correspondence to plant experimenters throughout the United States. As associate horticulturist of the Department's Plant Introduction Section he rendered long and much appreciated service in the assembling and dissemination of useful knowledge pertaining to bamboos and certain other

<sup>17</sup> Data from files of Plant Introduction Section.

<sup>18</sup> Data from files of Plant Introduction Section.

groups of plants introduced for trial in this country.

**Phyllostachys viridis** (Young) McClure cv. HOUZEAU (new cultivar).<sup>19</sup>

The Houzeau bamboo differs from the typical form of the species principally in having the sulcus of the (otherwise green) internodes of the culm greenish yellow in color. One 3-year-old plant has culms about 12 feet tall. The ultimate stature of mature plants is as yet unknown.

The Houzeau bamboo is represented at the Garden by a plant (P. I. No. 233849) that developed as a spontaneous mutation from a rhizome cutting of the typical form of the species (P. I. No. 77257). It came to the attention of the writer during a tour of an experimental planting that was put in at the Garden in the spring of 1956.

M. Jean Houzeau de Lehaie, in whose honor this bamboo is named is a Belgian plantsman, the results of whose enthusiastic introduction and study of living bamboos early in the century are recorded principally in the publication, *Le Bambou* (5).

**Phyllostachys vivax** McClure, Wash. Acad. Sci. Jour. 35: 292. 1945. (Figs. 52 and 53.)

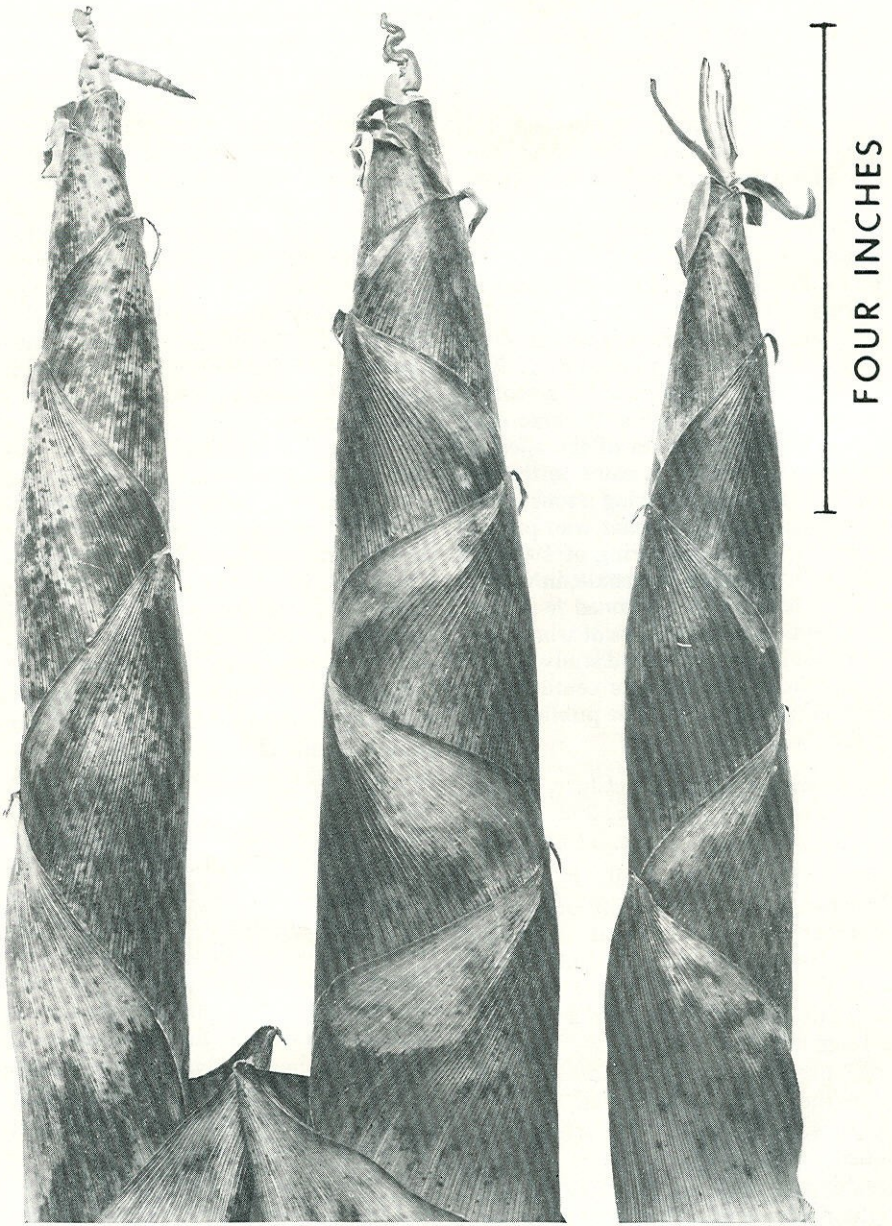
Culms up to 46 ft. tall,  $3\frac{3}{4}$  in. in diameter at the base, erect or nearly so, more or less perceptibly zigzag, often somewhat curved; internodes (No. 1: 2 in. long; No. 5:  $7\frac{3}{4}$  in. long; No. 20—the longest in a culm 46 ft. long, with 61 internodes— $14\frac{3}{8}$  in. long) green, perceptibly glaucous just below the nodes at sheath-fall, entirely glabrous, strongly and irregularly ribbed-striate; nodes more or less noticeably asymmetrical; nodal ridges of slight prominence, about equaling the

<sup>19</sup> Having come to light after the text of the handbook was prepared, this cultivar is not incorporated in the key.

sheath scar, or usually a little more prominent on one side; sheath scars entirely glabrous; culm sheaths creamy buff, farinose, maculate with smoky brown, the lowest spots sometimes almost completely black even on the margins; auricles and oral setae lacking; ligules relatively short, decurrent, convex at the apex, the margin ciliolate to setose; sheath blades narrowly triangular to ribbon-shaped, strongly reflexed, very crinkly; leaf sheaths with or without auricles and oral setae; ligules weakly exerted; leaf blades  $1\frac{3}{4} \times \frac{5}{8}$  in. to  $8 \times 1$  in., more commonly 4 to 6 in. long and  $\frac{5}{8}$  to  $\frac{3}{4}$  in. broad, glabrous or nearly so on the lower surface.

*P. vivax* is a strikingly beautiful species. Once it is known, it can be easily recognized at a distance by its elegant drooping foliage. There are only three bamboos of similar stature with which this species is likely to be confused, *P. bambusoides*, *P. dulcis*, and *P. viridis*. From *P. bambusoides* it may be distinguished by the pendulous foliage habit, the ribbed internodes glaucous from the first, the thinner culm sheaths, the entire lack of auricles, and the very strongly decurrent culm sheath ligules. From *P. dulcis* it may be distinguished by the more erect habit of the culms, the darker hue of the culm sheaths, and the entire lack of auricles on the culm sheaths. From *P. viridis* it may be distinguished by its thinner culm sheaths, the strongly convex and more pronouncedly decurrent culm sheath ligule, the crinkliness of the culm sheath blade, the ribbed-striate surface of the culm internodes, and the dark color of the culm sheaths, particularly the lowest ones.

*P. vivax* was obtained in the vicinity of Tang-si, Chekiang Province, China, by Frank N. Meyer in 1907. It is growing in the Garden under P. I. No. 82047.



P. I. S. NEG. 37204

FIGURE 52.—*Phyllostachys vivax* (P. I. No. 82047): Young shoots from Avery Island, La. Two of the lower sheaths have begun to fall away.

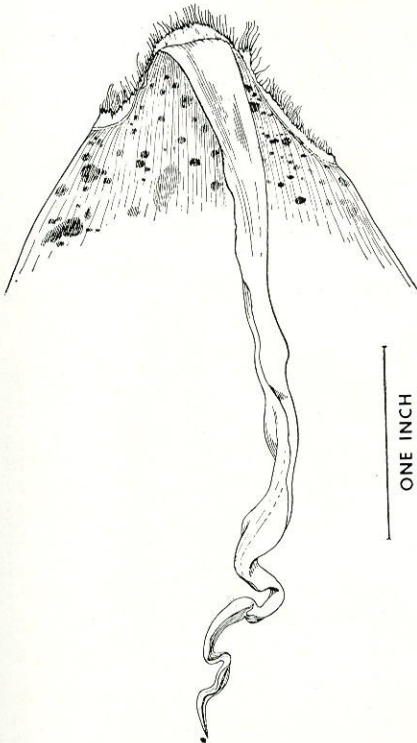


FIGURE 53.—*Phyllostachys vivax* (P. I. No. 82047): Apex of culm sheath, showing sheath blade and ligule.

Shoot initiation begins early mid-season. The shoots have been found to be entirely free from any unpleasant taste, or "bite," even in the uncooked state (13).

Culms of this bamboo were included in studies on seasoning and physical properties carried out at Clemson Agricultural College of South Carolina (3).

The plant is extremely vigorous. The late E. A. McIlhenny wrote of this bamboo as follows in a letter<sup>20</sup> dated June 4, 1941: "The new growth of P. I. 82047 averages ten days or two weeks earlier than that of *P. bambusoides*. The plant is much more vigorous, reaches maturity much more quickly, and the culms have much thinner walls than those of *P. bambusoides* \* \* \* When the two were planted side by side P. I. 82047 completely shaded and killed the growth of *P. bambusoides*." The minimum temperature tolerance of *P. vivax* is estimated at 5° F.<sup>20</sup> It is not known to be widely distributed in cultivation as yet, but it has been listed by at least three nurseries (11).

<sup>20</sup> Data from files of Plant Introduction Section.

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