Flowering and Seeding of Giant Bamboo (Sinocalamus latiflorus)

By TZE-TING WANG and MING-YI CHEN[1])

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The giant bamboo (Sinocalamus latiflorus (MUNRO) MCCLURE = *Dendrocalamus* latiflorus MUNRO) is one of the most important bamboos of Taiwan. It is cultivated at low and medium elevations in all parts of the island. At present there are more than 20,000 hectares of plantations.

This is the largest bamboo in Taiwan. Its culms or stems, which grow to mature size in one year but require another 1–2 years to become fully lignified, reach 25 m in height and 20 cm in diameter. It is widely used for construction purposes and to a limited extent for paper-making. The young shoots are esteemed for food and many plantations have been established primarily for bamboo shoot production.

Bamboo is a perennial grass which can live for many years, new culms arising annually from the sympodial rhizocauls. But if a clump flowers, it dies soon afterward and must be replanted. Thus, flowering is of great practical importance to bamboo farmers as well as to bamboo breeders.

We undertook the present study to learn more about the flowering habits of this species. Our observations extend over a 1% year period from October 1968 to March 1970. That is not long enough to learn all about a species which some farmers say requires a 60-year cycle from seed to flowering. So we have supplemented our own observations with the lore of farmers, but can not guarantee the accuracy of that lore because of the absence of detailed written records.

Flowering *and* Seed Production of a *Single Clump*

All culms in a single clump of giant bamboo flower the same season. Flowering occurs from October to January in Taiwan and is preceded by yellowing of the leaves and branch elongation. On a single culm, flowering starts on basal branches and proceeds upward. By the time of full bloom, most of the leaves have dropped.

For a single branch the period of full bloom varies between 20 and 30 days. Another 50—60 days elapse until the flowers wither. The few seeds we were able to find were mature in early April in Chiayi in northern Taiwan.

The flowers are borne in sessile spikelets which occur at the nodes, 5–10 per node. The spikelets are 1.6—2.5 cm long, slightly flattened and with sharp tips.

Each spikelet consists of 7–10 florets. The florets are bisexual, male ones having six yellow anthers about 6 mm long. Female florets have ovoid ovaries 2 mm across by 3 mm long, smooth below and hairy above. The 2-parted styles are slender and about 7 mm long. The glumes are sharply ovate. The lemmas are ovate, entire and smooth. The paleas are elliptical- lanceolate.

If the flowering culms in a clump are felled, new culms arise which have small leaves and which produce flowers immediately. On this type of culm there are 80—120 spikelets per node. After this secondary sprouting and flowering, the entire clump dies.

Although giant bamboo flowers frequently, seed production is sparse. The few seeds we found occurred one to a spikelet and were in the uppermost florets of the spikelets. The seeds were obovoid, 8 mm long, 4 mm across and 9–10 mm awns at their tips.

We germinated the seeds which we found in Chiayi in TUKEY's solution. About 80% germinated, requiring only 4 days. Growth was rapid and 6 days after germination the culms were 6 cm tall with one leaf, and the roots were 3 cm long. The young seedlings were field planted at National Taiwan University's Experimental Forest at Chi-tou in Nantou Hsien, central Taiwan.

Frequency of Flowering

We studied frequency of flowering in 24 bamboo fields located in Taipei Hsien (towns of Yung-ho and Hsin-tien) and Chiayi Hsien (town of Yi-chu) during the winters of 1968—69 and 1969—70. During these two seasons 164 of 2,106 clumps (= 7.8%) flowered and died. The frequency of flowering varied from 0 to 9% in 14 of the fields, from 10 to 18% in 9 fields, and exceeded 90% in only one field.

We were able to ascertain age since planting, which varied from 1 to 22 years and to study any possible relationship between that and frequency of flowering. The results are presented in Table 1. Apparently there was no consistent relationship because the percentage of flowering clumps was nearly the same in fields which had been planted 1–3 years as in fields which had been planted 20+ years.

Giant bamboo is commonly propagated vegetatively by splitting the below-ground portion into several parts, each part containing a vegetative bud which will grow into an aerial culm. It is probably most common for a farmer to use a single clone as the source of planting material for a particular field. Certainly, in a species which seeds as rarely as this, that would be much more common than to purposely propagate several different clones in a field.

If that hypothesis is correct, all clumps of a single clone do not flower and die the same year. Of the 24 fields which were studied, clump mortality exceeded 20% *in* only one field. In that case, a field which had been planted for 22 years, 14 of 15 of the clumps which were alive at the start of 1968 flowered and died during the next two winters.

Table 1. — Flowering frequency of giant bamboo clumps and age since planting, based upon data from 24 bamboo farms in Taipei and Chiayi Hsiens.

Age since planting	Number of clumps studied	Frequency of clumps which flowered and died
years	*number*	*percent*
1	125	16
2	313	4
3	373	8
4	459	6
5	36	11
7	18	5
10	29	10
20+	753	9
Total or average	2,106	7.8

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According to farmer's lore, giant bamboo requires more than 60 years from seed to flowering and death. According to our data, the annual rate of clump flowering and death is about 4%, which might be interpreted as showing an average life expectancy of 25 rather than 60 years. However, the logic of that calculation is open to question because we do not know the age from seed of any of our material.

According to farmer's lore intensive cultivation reduces flowering but we were not able to confirm or deny this. And there is a legend that flowering is increased by propagating pieces of the horizontally spreading rhizomes rather than by splitting the clumps vertically. Again, we were not able to obtain evidence on this point.

Abstract

Giant bamboo *(Sinocalamus latiflorus)*, one of the most important bamboos grown in Taiwan, flowers from October to January. Flowering is preceded by yellowing of the leaves and is followed by death of the clump. The few mature seeds which were found ripened in early April, germinated promptly, and grew 8 cm tall in 6 days. A 2-year survey of 24 bamboo fields in northern Taiwan showed that 3.9% of the clumps studied flowered and died each year. There was no relationship between time of planting and frequency of flowering, the average flowering rates being similar in fields which had been planted 1—3 years and 20+ years. We were not able to determine the effects of cultural practice or age from seed on frequency of flowering.

Key words: Flowering, seed production, giant bamboo, *Sinocalamus latiflorus*.

Zusammenfassung

Der Riesenbambus *(Sinocalamus latiflorus)* hat für Taiwan eine große Bedeutung. Er blüht dort von Oktober bis Januar. Nach der Blüte seiner Schößlinge stirbt der Wurzelstock (clump) ab. Die wenigen gefundenen Samen reifen Anfang April, keimen sofort, und die Sämlinge wachsen bis zu 8 cm Höhe in 6 Tagen. Eine 2jährige Untersuchung von 24 Bambusfeldern im nördlichen Taiwan ergab, daß jedes Jahr dort 3,9% der Wurzelstöcke blühten und absterben. Es bestand keine Beziehung zwischen der Pflanzzeit der Felder und der Häufigkeit der Blüte von einzelnen Wurzelstock-Horsten.

Short Note

Resin Canal Number Varies in Ponderosa Pine (Pinus ponderosa Laws.)

By Frederick Deneke and Robert W. Funsch[1])

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Examination of 77 geographic seed sources of ponderosa pine planted in an uniform environmental garden in 1968 at Kansas State University revealed variation in resin canal number. Of the 77, 62 had a consistent number of two resin canals per needle for the ten seedlings of each source examined. Sampling of 14 other geographic seed sources revealed a variation in one or two of the ten seedlings examined. One seed source, near Arnold, Nebraska, varied from two to seven resin canals with an average of 2.7 for the ten seedlings. Subsequent investigation of needles from this Nebraska origin indicated that their resin canal numbers were consistently high, often as high as eight or ten.

As this origin is isolated from other ponderosa pine populations by more than 100 miles, it may be a seed source for a potential new ecotype.

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Referate

Kaul, O. N., Gupta, A. C., and Negi, J. D. S.: **Diagnosis of mineral deficiencies in teak (Tectona grandis) seedlings.** Indian Forester **98**, 173—177 (1972).

Morphologische Symptome bei *Tectona*-Sämlingen werden beschrieben, die der Mangel an Hauptnährstoffen verursacht. Die Auswirkung auf das Wachstum, die Trockensubstanz-Produktion und die Nährstoffaufnahme dieser Pflanzen wird untersucht.

Seitz

Koenigs, J. W.: **Inoculation of southern pine seedlings with Fomes annosus under aseptic conditions.** Forest Sci. **16**, 280—286 (1970).

Verf. berichtet über seine 2½jährigen Versuche, eine Technik zu entwickeln um Sämlinge von *Pinus taeda* und *P. elliottii* var. *elliottii* unter sterilen Bedingungen mit *Fomes annosus* (16 verschiedene Herkünfte) zu infizieren. Stephan

Križan, P.: **Frostresistenz selektierter Provenienzen von Larix sp.** Vedecké práce VULH **13**, 127—146 (1970). *[Slowak. m. russ., engl., dtsch. Zsfg.]*

Aus dem IUFRO-Provenienzversuch in Podbansko wurden 10 Herkünfte mit Scheumanns Methode getestet. Die Ergebnisse wurden mit denen verglichen, die bei 10, 15 und 20 Jahre alten Provenienzen erhalten worden waren. — Zu den resistentesten Provenienzen gehören: Nr. 70 (Kravany), Nr. 51 (Čierny Váh) — beide aus der Slowakei — und Nr. 32 (Pruszków Szlaski aus Polen). Die alpinen Herkünfte zeigten die geringste Resistenz. — Wachstum, Massenproduktion und Frostresistenz waren signifikant gekoppelt mit der Fähigkeit der Provenienz, auf eine variierende Temperatur zu reagieren. Nach dem 10. Jahr nimmt dann der Einfluß der Temperatur auf das Höhenwachstum ab. — Diese Untersuchung soll die maximale Plastizität bei veränderlichen klimatischen Bedingungen klären. Seitz

Kruklis, M. V.: **Karyologic peculiarities of Picea obovata Ledeb.** Lesovedenije **5** (2): 76—84 (1971). *[Russ. w. sum.]*

In presented work is described the karyotype of *Picea obovata* Ledeb. Author has found, that in karyotype besides normal set of chromosomes are present additional B-chromosomes which are metacentric and rather smaller than normal ones. Their occurrence varies in populations following: 2n + B up to ca. 25%, 2n + 2B up to ca. 3%; 2n + 3B up to 1.8%. Paule

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