

S. Jolly\*, K.R. Yadav†, R.K. Sharma\*, R.M. Kothari\* and V. Ramamurthy\*: **Response of *Dendrocalamus strictus* (Roxb.) Nees Seedlings to Soil Conditioner and Plant Growth Regulator**

[Received June 20, 1997]

**Abstract**

Seedlings of *D. strictus* were studied for changes in shoot height, biomass and sugar levels in response to treatment with two growth promoting substances, Soil conditioner (SC) and Plant growth regulator (PGR). Treatment with SC showed only marginal increase in the biomass while foliar spray of PGR resulted in substantial improvement in the height as well as the biomass of treated plants. Combined treatment of SC and PGR was found to be more effective in enhancing the biomass of seedlings as compared to individual treatments. Sucrose, glucose and fructose were the major sugars detected in the extracts of *D. strictus* seedlings. These sugars were found to decrease in all the treated seedlings as compared to the untreated seedlings.

**Introduction**

Woody bamboos (Bambuseae), grasses characterized by their aboreal habit and high growth rates, are widely recognized as a versatile forest product of domestic and commercial significance (John *et al.*, 1995). Taken singularly, a given bamboo species is generally found to be suitable for a specific purpose only and very few bamboos can be qualified to be called multipurpose in usage (Bahadur, 1979). However, an excellent example of a multipurpose bamboo is *D. strictus*, which appropriately has been selected as one of the nineteen priority species of bamboo by the International Network for Bamboo and Rattan (Dransfield *et al.*, 1994).

*Dendrocalamus strictus* holds particular importance in India, where it is widespread in distribution (Varmah and Bahadur, 1980). Although its commercial utility, as the principal raw material for pulp in the Indian paper and rayon industry, is substantial, its value cannot be dismissed for the various cottage industries it sustains. These cottage industries, in turn often support the entire socioeconomic structure of many rural and tribal communities (Suri and Chauhan, 1984; Rao *et al.*, 1992). This valuable forest resource has, however, declined steeply over the years due to a combination of poor silvicultural and management practices, unregulated utilization, forest fires and poor regeneration after gregarious flowering (Paranjothy *et al.*, 1990). While the conservation of bamboo forests needs urgent attention, emphasis must also be directed on measures for rapid regeneration of degraded and less dense forests to mitigate the increasing demands on *D. strictus*. One means of achieving the above objective is to prepare healthy seedlings at the nursery which is the essential starting point for establishing productive forests.

The plant growth regulator (PGR) used in this study is an amino acid based plant hormone which enhances the quality and productivity of food crops like wheat, rice, and moong bean (Sharma and Kothari, 1993). Soil conditioner (SC) is an organic manure which has been shown to promote the growth of wheat seedlings and bulb and foliage biomass of onion (Ramamurthy *et al.*, 1996). To investigate the usefulness of these for raising healthy bamboo seedlings in the nursery, the present study examines the effect of individual and combined treatments on the shoot growth and sugar levels in *D. strictus* seedlings.

\*School of Biotechnology, Thapar Institute of Engineering & Technology, Patiala - 147001, India.

†Biotechnology Division, Thapar Corporate R&D Centre, Patiala-147001, India.

## Materials and Methods

**Growth in the nursery:** Seeds of *D. strictus* were obtained from the bamboo forests in Bhamragarh Forest Division (Central India). The dehusked seeds were washed with running tap water, treated with 10% Savlon (Johnson & Johnson Pvt. Ltd., Hyderabad) solution followed by rinsing with distilled water for 15 min., germinated in moist cotton at 30°C in one week. Equal numbers of germinated seedlings (80) were individually sown in nursery containers of the following four groups: (i) garden soil matrix and foliage sprayed with water once per week (control); (ii) garden soil matrix and foliage sprayed with PGR (.1%, v/v) once per week; (iii) SC:soil (1:3, v/v) matrix and foliage sprayed with water once per week; and (iv) SC:soil matrix and foliage sprayed with PGR once per week. All the seedlings in each treatment group were irrigated twice per week and maintained at 30±5°C for 5 weeks.

**Biomass analysis:** After 5 weeks seedlings were harvested. Shoots were separated from the roots, washed and weighed immediately for fresh weight. Moisture content was determined by drying at 70°C until constant weight.

**Sugar analysis:** Shoots were extracted by grinding at 4°C to a fine paste in a pestle and mortar. The paste was extracted in distilled water and frozen immediately until analysis. The sugar content in water extracts was analysed using a high performance liquid chromatography (HPLC) system (Waters Assoc., Milford, Massachusetts). Samples were separated in a Sugapak column at 90°C with CaEDTA (50 ppm). The eluted sugars were detected using a refractive index detector and quantified by comparison with reference standards.

**Statistical analysis:** Data were subjected to analysis of variance followed by a Tukey's mean separation test to determine treatment differences. Correlation between biomass and sugar content was analysed using Pearson's correlation coefficient.

## Results

**Biomass:** The effect of SC and PGR treatment on the growth of germinated bamboo seedlings is shown in Table 1. Although all the treated groups showed higher biomass compared to the untreated control, the effect of SC was only marginally higher. PGR treatment, on the other hand, resulted in much higher biomass increase, with or without SC.

**Sugar content:** Analysis of soluble sugars in bamboo shoot extracts revealed a significant and consistent detection of only three sugars - sucrose, glucose, and fructose in *D. strictus* seedlings. Compared to untreated seedlings, the sugar content in all the treated seedlings was found to be lower (Table 2). Although glucose content in seedlings was consistently lower in all three treatment groups, fructose content decreased only in plants which had received a combined treatment of SC and PGR. In individually treated seedlings, the fructose content was slightly decreased. Similarly, the sucrose content was also slightly lower in all the treated seedlings.

## Discussion

**Biomass:** Seedlings treated with PGR showed better growth relative to those that had received no PGR, both in terms of increase in shoot height and enhanced biomass. Statistical analysis of the differences in shoot height and biomass of plants of various treatment groups, showed that biomass was significantly increased in combined treatment versus individual treatments of SC and PGR. However, increased shoot height was observed only in the PGR treated seedlings. The effect of PGR on bamboo seedlings corroborates findings from earlier studies indicating enhanced growth of wheat and moongbean in response to PGR (Sharma and Kothari, 1993). The response of bamboo seedlings to SC, however, was restricted to a marginal increase in biomass in contrast to a marked improvement observed in shoot growth and development of the root systems of onion and wheat seedlings in earlier studies on SC

(Ramamurthy *et al.*, 1996; Rajor *et al.*, 1996). Since this study was limited to 6 week old seedlings, the effect of the growth promoting agents on rhizome growth could not be studied. However, such a study could prove valuable since rhizome growth strongly influences the growth rate of bamboo shoots in the field.

**Sugar content:** Analysis of sugar levels in treated and untreated plants was undertaken to evaluate their relationship with growth of plants and the effects of the growth modulating agents. The apparent inverse relationship between biomass and sugar levels, as observed in this study, suggests that as growth of *D. strictus* seedlings proceeds in the nursery, concomitantly levels of sucrose, glucose and fructose decrease. Since free sugars are considered to be an important storage form of carbohydrates in bamboos (Seki and Aoyama, 1994), a decrease in their level can be attributed to their utilization for growth. Although comparable studies investigating sugar profiles of bamboo seedlings are not found in the literature, decrease in sugar levels during periods of active growth has been reported in studies with the older culms of the bamboo *Sasa senanensis* (Seki and Aoyama, 1994) and also observed in our studies with freshly sprouted and maturing culms of *D. strictus* (unpublished data). Studies with culms of *Bambusa blumeana* and *Gigantochloa scortechinii*, however, indicate that levels of sugars change variably with age, culm height and their interaction in these bamboos (Mohmod *et al.*, 1994).

Statistical analysis of the data for gaining some insight into the relationship between growth and sugar levels, revealed a significant negative correlation between biomass and sugar levels only in seedlings that had received a combined treatment of SC and PGR (Table 3). The correlation between biomass and sugar content in control as well as in individually treated seedlings was not found to be significant. If the observed decreased sugar levels in the bamboo seedlings, in fact, reflect their increased utilization, this analysis suggests a more efficient utilization of the sugars for growth in the seedlings that had received a combined treatment of SC and PGR compared to individually treated and untreated seedlings. However, to gain a better insight into this relationship and to evaluate whether the observed depression in sugar levels can be attributed to growth or effect of the growth modulating treatments or both, further detailed studies are required.

In conclusion, the treatment of SC and PGR individually and in combination resulted in enhancement of growth of *D. strictus* seedlings, as is evident from the increase in shoot height and biomass of the treated seedlings and as indicated by the decreased levels of sugars.

### Acknowledgment

SJ acknowledges support from the Council of Scientific and Industrial Research, New Delhi.

### References

- Bahadur, K.N., 1979. Taxonomy of bamboos. *Indian Journal of Forestry*, 2: 222-241.
- Dransfield, J., Rao, A.N., Dransfield, S., Widjaja, E., Renuka, C. and A. Mohamad, 1994. *Priority Species of Bamboo and Rattan*, (eds. Williams, J.T. and V. Ramanatha Rao), INBAR and IPGRI, New Delhi, India.
- John, C.K., Nadgauda, R.S. and A.F. Mascarenhas, 1995. Bamboos - some newer perspectives. *Current Science*, 68: 885-896.

- Mohmod, A.L., Khoo, K.C. and N.A.M. Ali, 1994. Carbohydrates in commercial Malaysian bamboo. In: *Bamboo in Asia and The Pacific*, IDRC, Canada, FAO, U.N. and United Nations Development Programme, pp. 227-229.
- Paranjothy, K., Saxena, S., Banerjee, M., Jaiswal, V.S. and S.S. Bhojwani, 1990. Clonal multiplication of woody perennials. In: *Plant Tissue Culture: Applications and Limitations*, (ed. Bhojwani, S.S.), Elsevier, Amsterdam, pp. 190-219.
- Rajor, A., Sharma, R., Sood, V.K. and V. Ramamurthy, 1996. A sawdust-derived soil conditioner promotes plant growth and improves water-holding capacity of different types of soils. *Journal of Industrial Microbiology*, 16: 237-240.
- Ramamurthy, V., Sharma, R.K., Yadav, K.R., Kaur, J., Vrat, D. and R.M. Kothari, 1996. *Volvariella*-treated *Eucalyptus* sawdust stimulates wheat and onion growth. *Biodegradation*, 7: 121-127.
- Rao, I.V.R., Rao, I.U. and F.N. Roohi, 1992. Bamboo propagation through conventional and *in vitro* techniques. In: *Rapid Propagation of Fast Growing Woody Species*, (ed. Baker, P.W.G.), C.A.B. International, Wallingford, U.K., pp. 41-56.
- Seki, K. and M. Aoyama, 1995. Seasonal variation in storage carbohydrates and cell wall components of the culm of bamboo grass. *Cellulose Chemistry and Technology*, 29: 561-566.
- Sharma, R.K. and R.M. Kothari, 1993. Recycled cereal proteins as foliar spray enhances quality and production of food crops. *Resources, Conservation, and Recycling*, 9: 213-221.
- Suri, S.K. and R.S. Chauhan, 1984. *Bamboo*. Forest Research Institute, Dehra Dun, India.
- Varmah, J.C. and K.N. Bahadur, 1980. In: *Indian Forest Records: Country report and status of research on bamboos in India*, Vol. 6, F.R.I. Press, Dehradun, India, pp. 28.

Table 1. Effect of treatment on shoot height and biomass of *D. strictus* seedlings.

Treatment	Mean Shoot Height ± SD(cm)	Average Shoot Biomass ±SD (mg)	
		Fresh Weight	Dry Weight
Nil (Control)	2.4 ± 1.2	82.5 ± 17.0	24.3 ± 5.0
SC	2.6 ± 1.6	88.4 ± 16.3*	26.9 ± 5.0**
PGR	3.2 ± 1.6*	97.2 ± 6.1**	32.1 ± 5.3**
SC + PGR	3.7 ± 1.9**	105.3 ± 23.3**	35.0 ± 7.7**

\* p&lt; 0.05, \*\* p&lt; 0.01

Table 2. Effect of treatment on sugar levels of *D. strictus* seedlings.

Treatment	Average Sugar Content ± SD (mg/g)		
	Sucrose	Glucose	Fructose
Nil (Control)	62.9 ± 6.5	68.0 ± 23.1	71.9 ± 23.2
SC	53.7 ± 13.8	47.0 ± 14.9**	65.1 ± 15.5
PGR	54.5 ± 13.3	47.1 ± 19.5**	55.8 ± 23.3
SC + PGR	52.4 ± 16.3	46.3 ± 18.6**	42.4 ± 18.2*

\* p&lt; 0.05, \*\* p&lt; 0.01

Table 3. Correlation between biomass and sugar levels in different treatment groups (df=4).

Treatment	Correlation Coefficient (r)		
	Sucrose	Glucose	Fructose
Nil (Control)	-0.61	-0.48	-0.25
SC	-0.70	-0.75	-0.58
PGR	-0.35	-0.79	-0.24
SC + PGR	-0.91**	-0.96**	-0.94**

\* p&lt; 0.05, \*\* p&lt; 0.01

Phillip J. Stager\*: Bamboo and Philately

[Received May 26, 1999]

### Introduction

Welcome to the wonderful worlds of bamboo and philately. This article will examine the world of bamboo through the eyes of a stamp collector. Bamboos, like all living things, are classified by the binomial system of nomenclature devised by Carl Linnaeus, honored by his native Sweden with the stamp in Figure 1. At least 76 bamboo genera, of which approximately 29 are economically important, and twelve to fifteen hundred species, have been identified. Only a few are shown on a philatelic element, i.e. postage stamp, cancel, postal card, meter stamp, or revenue stamp.



Figure 1.



Figure 2.

Distribution.

Bamboos can be found from the northern islands of Japan down to the southern tip of Chile and are native to all continents except Europe and the Antarctic. Many temperate species were introduced to Europe via Botanical Fairs and Exposition in the early 1900's. Figure 2 shows an unidentified species at the 1907 Mannheim International Culture and Garden Show. Figure 2 is a printed to private order postal card that was canceled at a special post office at the show.

Two bamboos (*Arundinaria gigantea* and *A. tecta*) are native to the continental United States. Bamboo thickets or canebrakes covered large areas from Maryland to Texas and especially in the Carolinas, which suggested the name for the post office in Figure 3, Bamboo, NC. The countries of the Caribbean and South America are especially poor in bamboo stamps. Jamaica shows a lovely arched bamboo walkway on the stamp in Figure 4; and Bolivia recently issued the stamp in Figure 5 that depicts a three-toe sloth clinging to a large *guadua* culm. Jamaica also has a Bamboo post office as shown by the Registered envelope in Figure 6.

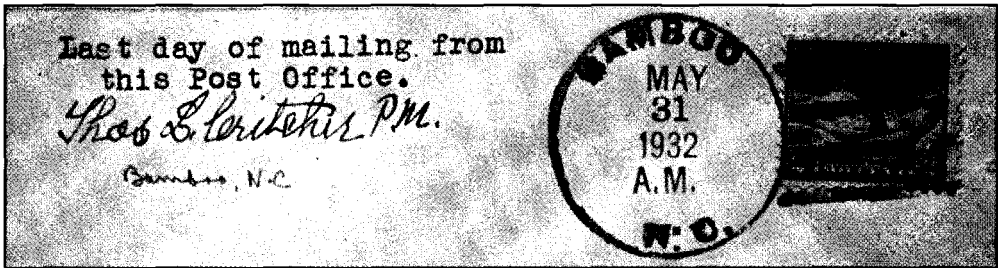


Figure 3.



Figure 4.



Figure 5.

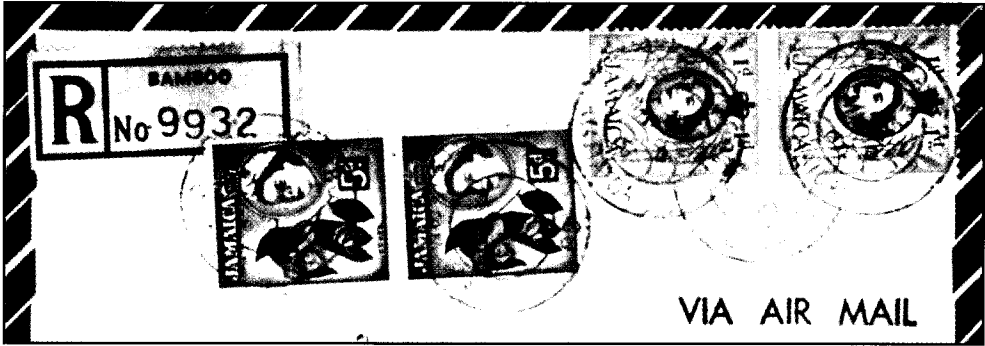


Figure 6.

Africa and the Indian subcontinent have little to offer the bamboo loving stamp collector. Most bamboos serve as backgrounds for local animals like the sun bear from Bangladesh or the gorilla from the Belgian Congo in Figure 7. The one stamp from Africa that shows only bamboo is shown in Figure 8 - which is cropped from a souvenir sheet promoting tourism in 1938. Australia has several towns named for bamboo, but no post offices were ever located in them so no postal markings can exist from them.



Figure 7a.



Figure 7b.



Figure 8.

Asia and the Orient have the greatest number of bamboo species, the greatest appreciation of bamboo, and provide the greatest number of philatelic items for this article. Figure 9 shows several unidentified species from China. The difficulties is positively identifying some bamboos from a picture the size of a postage stamp should be obvious. Postal authori-



Figure 9.

ties are generally more interested in producing an attractive postage stamp at low cost rather than producing a botanically accurate rendition of our favorite bamboos. However, a few are recognizable. Figure 10 shows two readily identifiable species from Indonesia - *Dendrocalamus asper* and *Schizostachum brachycladum*, and Figure 11 shows some *Sasa quelpartensis* from Korea. The souvenir sheet from China in Figure 12 shows a clump of *Phyllostachys pubescens*, commonly called *moso* in both Japan and the U.S. *Moso* is a very important bamboo in China since *moso* covers some 2 million hectares of China's 3 million hectares of bamboo forest. China also features bamboo on its postal stationery, especially the pictorial postal cards in which the indicium (the part that looks like a stamp and pays the postage) is the same as the pictorial design. Figure 13 shows a postal card titled Nine-Horse Fresco Hill on the Lijiang River in Guilin Province. Note the unidentified species of bamboo in the foreground, the bamboo raft in midstream, and the bamboo yardarm and mast on the boat. The crew of the boat is probably dining on bamboo shoots in the boat's cabin.



Figure 10a.



Figure 10b.



Figure 11.



Figure 12.



Figure 13.

Uses of Bamboo

The uses of bamboo are limited by the availability of raw material and by one's imagination and creativity. People throughout the world use bamboo for, in, and throughout their houses and homes. Figure 14 shows a Laotian house and Figure 15 shows a house on Rabaul in the middle of a coconut grove. Bamboo is also used for home furnishings; the Viet-



Figure 14.



Figure 15.



Figure 16.

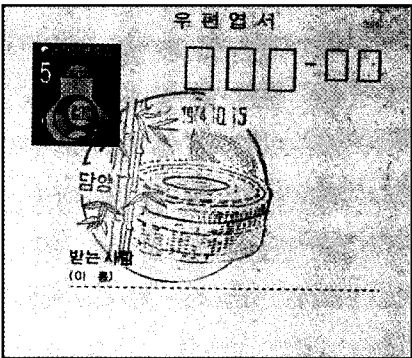


Figure 17.

name lady in Figure 16 rests comfortably on a bamboo bench. Bamboo baskets come in all shapes and sizes as shown by the cancel in Figure 17 and the stamps in Figure 18 where the bamboo is combined with rattan. A Japanese tea ceremony would not be complete without the tea whisk in Figure 19.

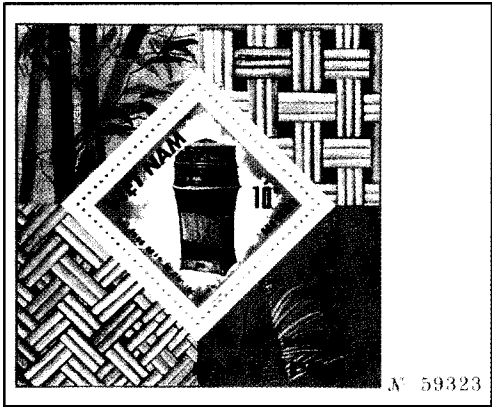


Figure 18.

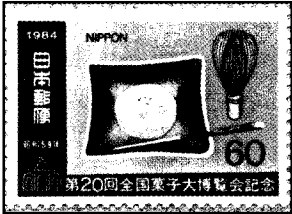


Figure 19.

Bamboo handles and ribs are important components of parasols and umbrellas. The Cambodian craftsman in Figure 20 sits on a mat of woven bamboo and fabricates baskets and a parasol of bamboo.



Figure 20.

The world of engineering has barely explored bamboo's uses. However, the suspension cables in the Chu Pu Bridge (Figure 21) in Kwan Sien, China are of woven bamboo. Early turn-of-the-century airships by the Brazilian aeronauts Augusto Severa and Santos

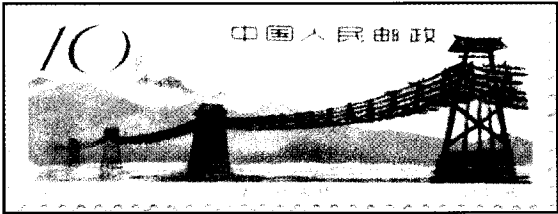


Figure 21.



Figure 22a.



Figure 22b.

Dumont used bamboo in their frames and gondolas (Figure 22). A carbonized bamboo filament was used by Thomas Edison in one of the earliest successful electric lightbulbs. Both the stamp and the cancel in Figure 23 commemorate Edison's discovery. A variety of bamboos and other tropical plants are a feature at the Edison summer estate in Ft. Meyers, FL.

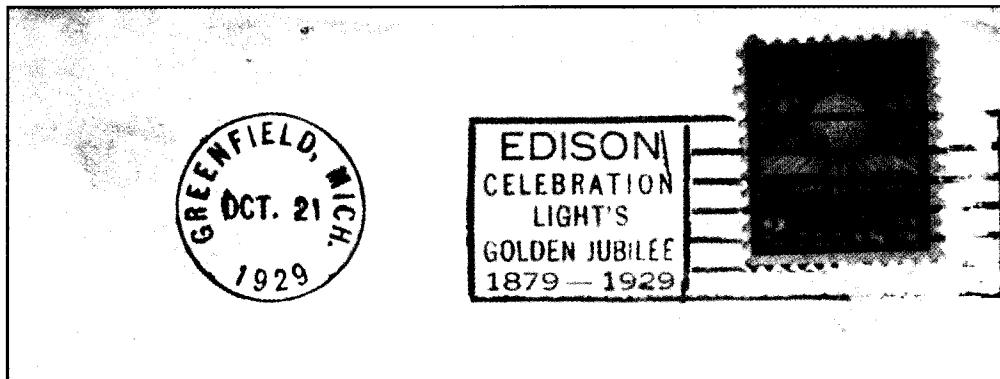


Figure 23.

Bamboo was used in a variety of sporting and recreational activities. Before fiberglass and plastics, one could find bamboo used for stilts (Figure 24), ski poles, or poles in pole vaulting. Many fly fisherman still prefer a fine handcrafted bamboo pole of *Arundinaria amabilis* (Figure 25).

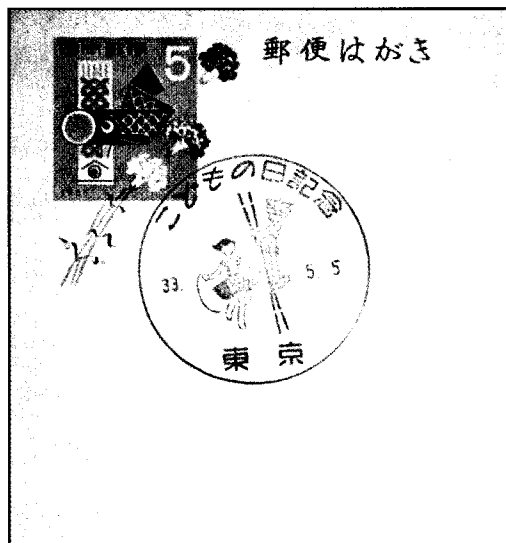


Figure 24.

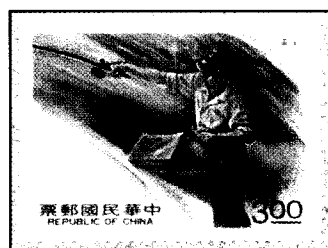


Figure 25.

Bamboo pens and paper are common in the Orient (Figure 26). Bamboo has been used as the raw material for paper for centuries and was commemorated by China in the stamps in Figure 27 which show Tasi Lin, the inventor of paper, and an early paper making facility. Since 1900 India has been a major supplier of fine bamboo papers. In 1944 the Titaghar Paper Company provided the laid, cream colored, bamboo paper for the Pacheng printing of the Chinese stamps in Figure 28 since China's economy was in ruins due to World War II. Extensive research in bamboo and especially bamboo papermaking has been conducted in

India at the Forestry Research Institute, Dehra Dun (Figure 29) since 1870.



Figure 26a.



Figure 26b.



Figure 27a.



Figure 27b.



Figure 28a.

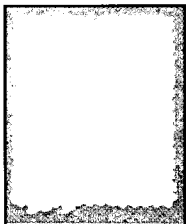


Figure 28b.



Figure 29.

Figure 30 shows a product almost everyone, or at least everyone reading this journal, knows, edible bamboo shoots. Figure 31 shows a philatelically inspired cover with bamboo



Figure 30a.

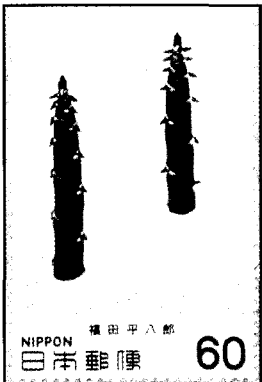


Figure 30b.



Figure 30c.

shoots on a local surtax stamp from Hubei Province, China together with the regular issue China stamps that depict several culms of *Bambusa ventricosa* and *Phyllostachys nigra*. Figure 32 shows one of the more unusual uses of bamboo - Baker's Bamboo Brier Compound - good for rheumatism, eczema, dyspepsia, indigestion, and varicose veins! Unfortunately, the author has no first hand experience with this dubious remedy.



Figure 31.

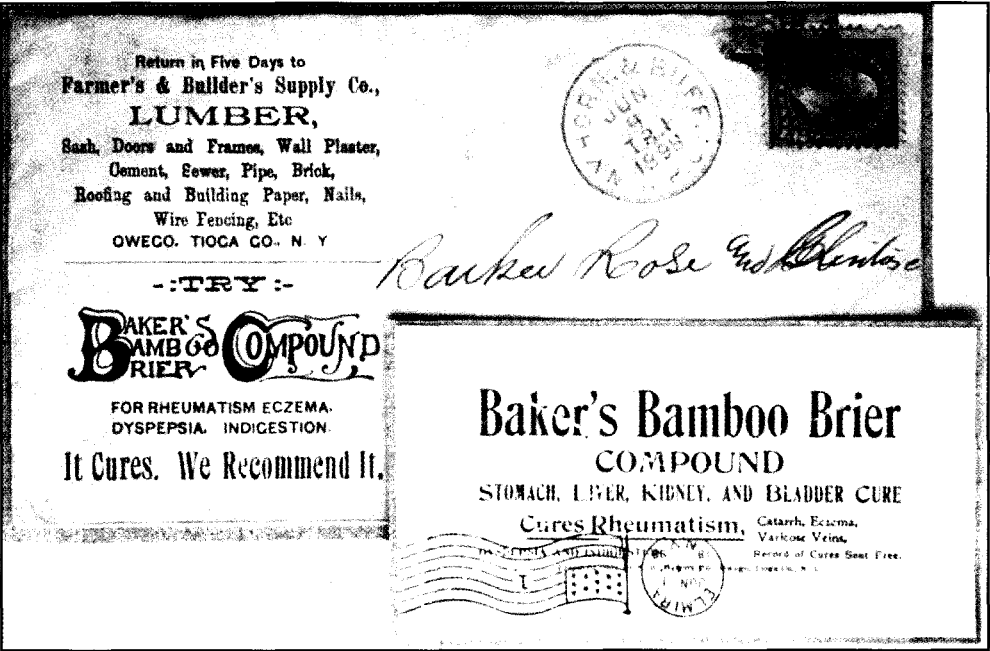


Figure 32.

Bamboo has a variety of nautical uses from the simple raft from Palau in Figure 33, a more elaborate lakatoi from Papua-New Guinea in Figure 34, and the ubiquitous junk in Figure 35 which uses bamboo for sail battens, yardarms, and cabin partitions. A sturdy bamboo pole propels the Chinese boat in Figure 36; the pole is also useful beating off the demon that threatens it. Bathtub sailors will be content with the small Chinese toy boat of bamboo in Figure 37.

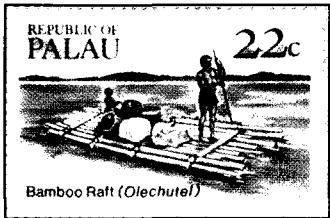


Figure 33.



Figure 34.

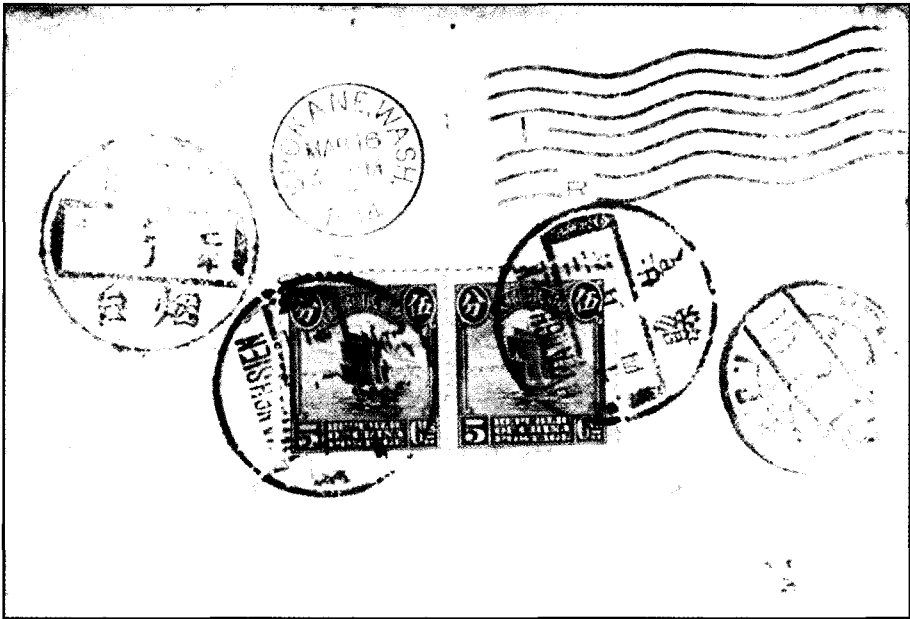


Figure 35. 1914 Hwanghsien to U.S.A. via I.J.P.O. Chefoo.



Figure 36.

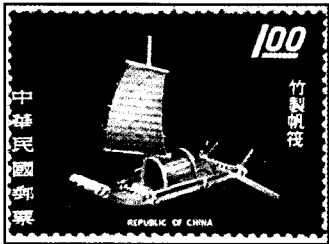


Figure 37.

Bamboo has been used for a variety of weapons - like the primitive spears from Papua New Guinea in Figure 38, the ritual kendo sticks (Figure 39), or the arrow shafts from *Psuedosasa japonica*, commonly called arrow bamboo (Figure 40).



Figure 38a.

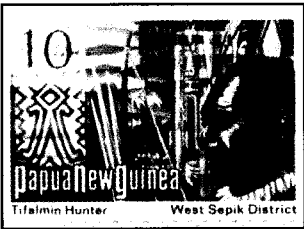


Figure 38b.



Figure 39.

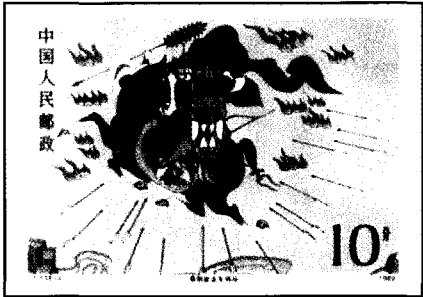


Figure 40a.



Figure 40b.

Bamboo is used for a great variety of artistic purposes including musical instruments like the pan pipes and flutes from Laos in Figure 41. A Papuan *Sing Sing* would not be complete without a bamboo *iviliko* and bamboo nose flute (Figure 42). When in the Philippines, be sure to hear the bamboo organ in the Church of Las Pinas in Rizal (Figure 43). This amazing instrument was built by Fr. Diego Cera from 1816-22. Bamboo is used by musicians throughout the world - from this group in the Solomon Islands in Figure 44 to the quartet from St. Vincent in Figure 45. Bamboo serves a medium for the engravings from New Caledonia in Figure 46 and has inspired the Korean celadon pottery design in Figure 47. Bamboo is also the subject matter for many Chinese paintings. The meter stamp in Figure 48 recommends beauty and happiness in Chinese art which is exemplified in the paintings and

on the fans:

- A. Cranes and Bamboo by Chen Chi-Fo
- B. Fan painting by Zheng Banqiao
- C. Ming Dynasty painting by Hsiang Te-hsin
- D. Singing Creek with Bamboo Orchestra by Madame Chiang
- E. Bamboo and Birds, Sung Dynasty
- F. Rock and Bamboo by Hsia Ch'ang



Figure 41a.



Figure 41b.

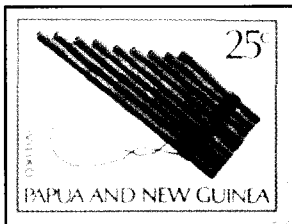


Figure 42a.



Figure 42b.



Figure 42c.



Figure 43.



Figure 44a.



Figure 44b.

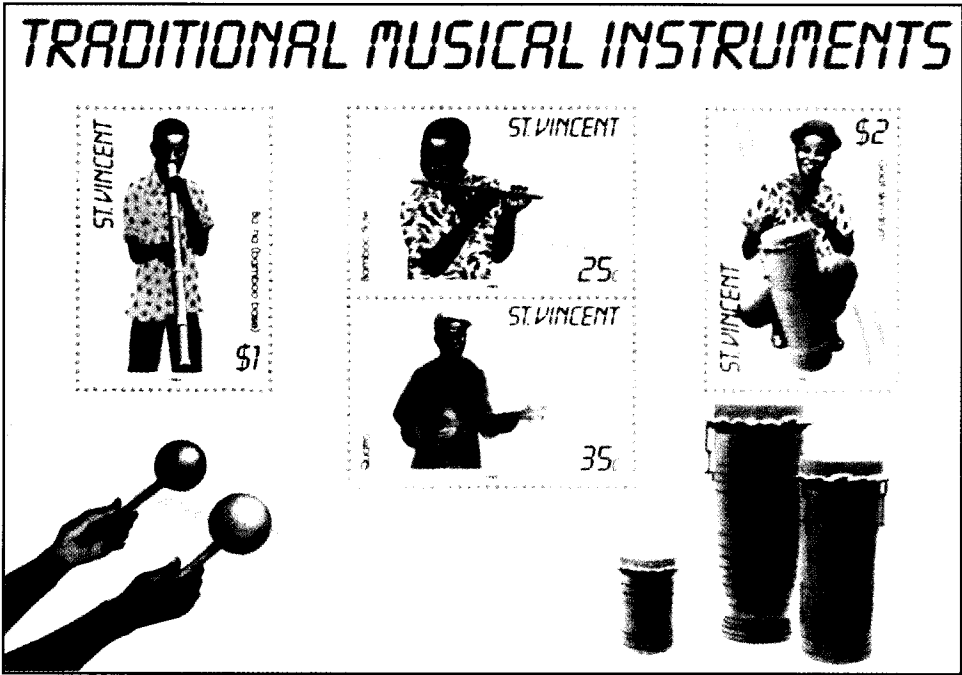


Figure 45.



Figure 46a.

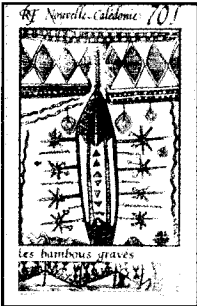


Figure 46b.



Figure 47a.

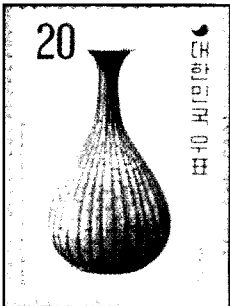


Figure 47b.



Figure 48a.

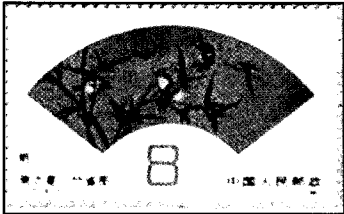


Figure 48b.



Figure 48c.



Figure 48d.



Figure 48e.



Figure 48f.

Bamboo provides shelter, nesting material, and forage for animal species as different as the birds in Figure 49, the huge domesticated elephant in Figure 50, and a tiny tarsier in Figure 51. Finally, in Figure 52 we see the animal most commonly associated with bamboo - the giant panda (*Ailuropoda melanoleuca*). Figure 53 shows the only U.S. stamp to picture even a trace of bamboo. Note the small sprig of green bamboo under the panda. This particular stamp has been neatly canceled by two additional bears who recommend we do something wild - like collect stamps.

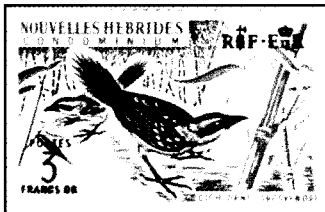


Figure 49a.



Figure 49b.

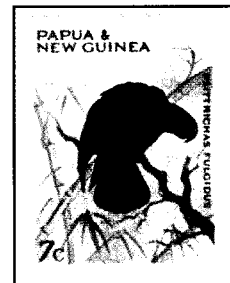


Figure 49c.

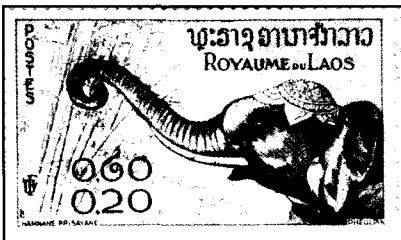


Figure 50.



Figure 51.



Figure 52a.



Figure 52c.



Figure 52d.



Figure 52b.

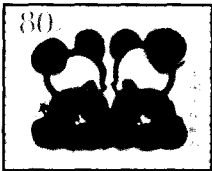


Figure 52e.



Figure 53.

Let us conclude our philatelic tour of the world of bamboo with the commemorative hand cancel from the temporary postal station at the ABS Annual Meeting at Harry P. Leu Botanical Gardens in Orlando, Florida (Figure 54).

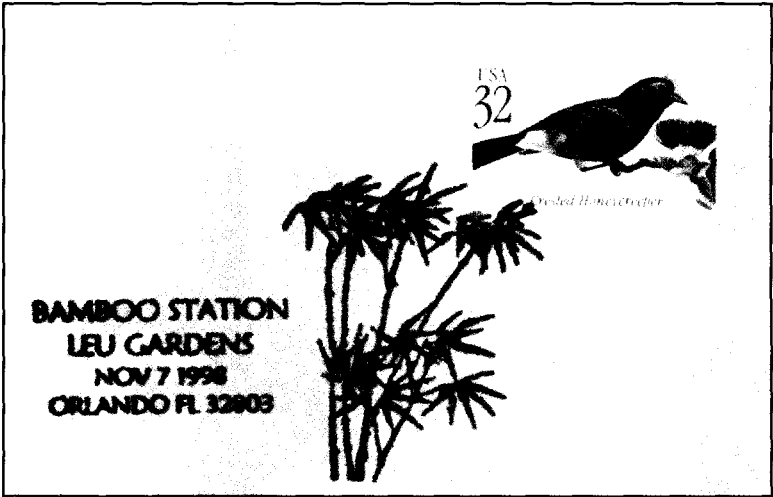


Figure 54.

Table 1.

Illustration	Country	Price	Year
1	Sweden	50 ore	1939
2	Germany	5 pfennig	1902
3	USA	2 cents	1932
4	Jamaica	2 shilling	1938
5	Bolivia	1 Boliviano	1998
6	Jamaica	---	1961
7a	Bangladesh	40 paisas	1977
7b	Belgian Congo	1 franc	1959
8	Belgian Congo	90 centimes	1938
9	ROC	\$16.50	1995
		\$11	1986
		\$7.50	1988
10	Indonesia	700, 300 rupiahs	1995
11	Korea	4 wan	1965
12	PRC	5 fen	1993
13	PRC	70 huan	1984
14	Laos	150 kip	1971
15	PNG	7 toae	1976
16	Viet Nam (S)	6 piastre (dong)	1969
17	Korea	-	1974
18	Viet Nam (N)	10 dong	1986
19	Japan	60 yen	1984
20	Cambodia	5 riel	1965
21	PRC	10 fen	1962
22	Brasil	200, 300 reis	1929
23	USA	2 cent	1929
24	Japan	5 yen	1956
25	ROC	\$3.00	1992
26a	Viet Nam (S)	50 piastre (dong)	1972
26b	Viet Nam (S)	5 piastre (dong)	1972
27	PRC	4 fen, 4 fen	1962
28	China	\$2.00	1944
29	India	2 annas	1954
30a	ROC	50 cent	1971
30b	Japan	60 yen	1981
30c	Viet Nam (S)	7 piastre (dong)	1961
31	PRC	3, 40, 40, 20, fen	1993
32	USA	-	1898
33	Palau	22 cents	1985
34	PNG	7 cents	1975
35	China	2 x 5 cent	1914 cover
36	PRC	1.30 fen	1989
37	ROC	\$1.00	1973
38	PNG	\$1.00 & 10 cents	1973
39	Japan	10 yen	1972
40	PRC	10, 20 fen	1989

Table 1, continued.

Illustration	Country	Price	Year
41a	Laos	2 kip	1957
41b	Laos	4 kip	1957
42a	PNG	25 cents	1969
42b	PNG	\$2.00	1973
42c	PNG	35 cents	1979
43	Philippine Is.	6 centavos	1964
44	British Solomon Is.	4 cents, 45 cents	1973
45	St. Vincent	dollar and cents	1985
46	New Caledonia	44 and 70 franc	1989
47	Korea	20 won	1977
48a	PRC	8 fen	1962
48b	PRC	8 fen	1982
48c	ROC	\$1.00	1973
48d	ROC	\$2.00	1987
48e	ROC	\$2.50	1969
48f	ROC	\$10.00	1977
49a	New Hebrides	3 francs	1968
49b	Thailand	1.50 baht	1976
49c	PNG	7 cents	1967
50	Laos	20 cents	1958
51	Philippine Is.	2 centavos	1969
52a	PRC	50 fen	1985
52b	PRC	20 fen	1985
52c	PRC	3 yuan	1985
52d	PRC	8 fen	1985
52e	PRC	80 fen	1985
53	USA	29 cents	1992
54	---	---	1998

## Journal of the American Bamboo Society

### Instructions to Authors

The Journal of the American Bamboo Society considers for publication manuscripts relating to bamboo generally and includes but is not restricted to the areas of anatomy, agroforestry, art, botanical history, conservation, cultural anthropology, culture, ecology, ethnobotany, forestry, morphology, paleobotany, palynology, pathology, propagation, phytogeography, systematics and utilization. All manuscripts are peer reviewed and acceptance of the manuscript will be contingent upon the recommendations of the reviewers.

For manuscripts in which nomenclature is treated or new taxa are described, please contact the editor for specific instructions.

There are no per page charges to authors unless there are last minute revisions which impact the printing schedule or special requirements not normally included in the typesetting/printing process.

Authors must strictly follow the checklist below and include a copy of the checklist with the items checked off with their manuscript submission. Any manuscript not correctly prepared will be returned prior to review for the deficiencies to be corrected. Include the correct number of copies and do not send original artwork until requested with post-review revisions. All original artwork will be returned to the author after publication.

Illustrations and tables should be carefully planned to be informative without wasting space or being redundant. They should be designed to be reproduced with little or no reduction and they must fit within a 131 by 217 mm page. Allow 25 mm of white space around each illustration. All originals and review copies of illustrations must be identified with author name(s) and figure number on the back of the illustration.

To expedite the printing process authors are required to submit post-review revised manuscripts on computer diskette as well as two typescript copies.

Proofs are sent to the authors for final review before publication. Authors should make only necessary changes in the proof.

Authors are encouraged to contact the Editor for any aspect of manuscript preparation that is unclear or extraordinary.

### Checklist for Preparation of Manuscripts

#### General Instructions

- ☐ Consult the most recent issue for formatting guidance.
- ☐ Print manuscript on 8 1/2 by 11 or A4 paper, use a clear non-proportional font (10 or 12 pitch; Courier, for example), do not right justify the text and use only one side of the paper.
- ☐ Provide a 1" (25mm) margin on all sides of the text. No hyphens or dashes at the end of a line.
- ☐ Underline those words that will appear italicized when typeset.
- ☐ Common Latin words or phrases should not be italicized (e.g., et al., i.e., sensu, etc.).
- ☐ Print the last name of the author(s) and the page number in the upper right hand corner of every page.
- ☐ Assemble the manuscript (as appropriate) as follows: Title page, Abstract page, Text, Taxonomic Treatment, Acknowledgments, Literature Cited, Figure Captions,

Illustrations, Tables, and Data.

- ☐ Do not staple the manuscript.
- ☐ No footnotes.

### **Title Page**

- ☐ Page one but do not number it.
- ☐ Starting 3" (78 mm) below the top of the paper list in all capital letters the author('s) surname(s), a colon, and a short title.
- ☐ A few lines lower provide a centered title using both upper and lowercase. Omit authors of scientific names.
- ☐ Below the centered title provide the author(s) full name(s), affiliations(s), and unabbreviated complete address(es). If an author is not currently at the above address then indicate a current address for the author with the words "Present address" preceding it.
- ☐ No footnotes.

### **Abstract Page**

- ☐ Page two (number it).
- ☐ Abstract must be one paragraph.
- ☐ Do not cite references, taxonomic authorities, or use abbreviations in the abstract.
- ☐ Be concise, but include brief statements about the paper's intent, materials and methods, results, and significance of findings.
- ☐ Indicate all new taxonomic names in boldface, including any new combinations.

### **Text**

- ☐ Page 3, etc...
- ☐ Within this section, text should be organized appropriately (e.g., Introduction, Materials & Methods, Results, Discussion, etc ...)
- ☐ Cite each figure and table in the text. Organize text, as far as possible, so that they are cited in numerical order. Use "Figure" only to start a sentence; otherwise, "Fig." if singular, "Figs." if plural.
- ☐ Use standard units of measure without spelling them out (e.g., hr, min, sec, yr, mo, wk, d, diam, m, cm, mm,  $\mu\text{m}$ ); format temperature units by giving the temperature followed by "°C" (e.g., 25°C).
- ☐ Write out abbreviations used in the text the first time and abbreviate thereafter (e.g., "The use of indolacetic acid (IAA) ...").
- ☐ Numbers one through nine should be written out unless a measurement or part of a taxonomic description (e.g., five samples, 2 cm, 40 gridded plots, 6 mo). Further conventions: use 1,000 instead of 1000; 0.22 instead of .22; % instead of "percent".
- ☐ Each reference cited in the text must be listed in the Literature Cited section, and vice versa.
- ☐ Literature citations in the text are as follows:
  1. One author — (Jones, 1990) or Jones (1990)
  2. Two authors — (Jones and Jackson, 1990) or Jones and Jackson (1990)
  3. Three or more authors — (Jones et al., 1990) or Jones et al., (1990).  
ALL AUTHOR NAMES MUST BE INCLUDED IN THE LITERATURE CITED SECTION.
  4. Manuscripts accepted for publication but not yet published — Jones and Smith (in press) or (Jones and Smith, in press)

5. Unpublished materials — J. Jones (unpubl. data); J. Jones (in mss.); (J. Jones, pers. obs.); or (J. Jones, pers. comm.)

6. Within parentheses, use a semicolon to separate different types of citations. For example, (Fig. 4; Table 2), (Felix and Smith, 1998; Jones and Ackerman, 1977).

- ☐ Organize citations within parentheses by year with the oldest being first. In the event that two citations by a given author occurred in the same year - add a letter after the year (starting with "a") and maintain the same designation in the Literature Cited section (e.g., (McClure, 1935a), or (McClure, 1935b; McClure, 1935c).
- ☐ Main headings are all capitals and centered on one line. They will be typeset bold.
- ☐ Second level headings should be indented normally and underlined. These will be typeset in bold italics.
- ☐ Third level headings, when needed, should be indented normally and be all capitalized. They will be typeset lowercase bold with key words capitalized.
- ☐ Taxonomic authorities should be cited for *all* taxon names at species rank and below at their first usage in the text, figure captions or referenced in a table.
- ☐ Terms in biological chemistry should follow either the IUPAC rules on biological chemistry nomenclature, the instructions to authors of the *Biochemical Journal*, or the notes given at the beginning of each number of the *Journal of Biological Chemistry*.

### Taxonomic Treatment

- ☐ Continue page numbers.
- ☐ The authors should have examined all types cited. In type citations, indicate the duplicate that you have not seen with "n.v." Do not use "!" for duplicates you have seen. Include the initials of collectors of type specimens.
- ☐ Use *Authors of Plant Names* (1992, by R. K. Brummit and C. E. Powell, Royal Botanic Gardens Kew) for authors of botanical names.
- ☐ References cited only as part of nomenclatural matter and not elsewhere are not included in Literature Cited; use Taxonomic Literature 2 or *Botanico-Periodicum-Huntianum* for abbreviations.
- ☐ Use *Index herbariorum*, 8th ed. (*Regnum Veg.* Vol 120. 1990) for designations of herbaria.
- ☐ If specimens are cited, use the following forms:  
 TYPE: MEXICO. Nuevo León: 24 km S of San Roberto Jct., 26 Sep 1970, Turner 6214 (holotype: TEX!; isotype: UC!).  
*Representative specimens examined:* U.S.A. Michigan: Lapeer Co., along Flint River, 1.5 mi NE Columbiaville, 5 Jul 1955, Beal s.n. (NCSC). Ohio: Wood Co., just W Scotch ridge, 7 Jun 1955, Beal 1073 (US). (etc.).
- ☐ Each country (CANADA, MEXICO, U.S.A.) begins a new paragraph.
- ☐ Do not use "paratype".
- ☐ Abbreviate subspecies as subsp.
- ☐ List of exsiccatae: see Brittonia 46:295 for an example.
- ☐ Papers in such disciplines as anatomy, ethnobotany, cytology, and phytochemistry must cite voucher specimens.
- ☐ Papers in molecular systematics presenting original data will not be accepted for review unless they include citation of herbarium voucher specimens and their location. Post-review final manuscripts will not be published if they do not contain accession numbers registered in an international database (e.g., GenBank).

### Literature Cited

- ☐ Continue page numbering.
- ☐ Verify all entries against original sources, especially journal titles, accents, diacritical marks, and spelling in languages other than English. Capitalize all nouns in German. Double check for spelling and details of publication.
- ☐ Cite references in strict alphabetical order by first author's surname. References by a single author precede multiauthored works by the same senior author, regardless of date. Of those multiauthored works, 1) references with two authors precede all other multiauthored works and are listed in alphabetical order and 2) references with three or more authors are listed in alphabetical order of authors, regardless of the number of authors involved.
- ☐ List works by the same author(s) chronologically, beginning with earliest date of publication.
- ☐ Use a long dash when the author(s) is/are the same as in the immediately preceding citation. See recent issues for examples.
- ☐ "In press" citations must have been accepted for publication and the name of the journal or publisher included.
- ☐ Insert a period and space after each initial of an author's name.
- ☐ Leave one space between the colon following the volume number and the page number(s).
- ☐ WRITE OUT JOURNAL NAMES IN FULL. Do not use abbreviations.
- ☐ If a citation cannot be completed at bottom of page, move the entire citation to the next page

### Figure Captions

- ☐ Continue page numbering.
- ☐ Double-space captions and group them according to figure arrangements. Quadruple space between groups. Do not use a separate page for each group.
- ☐ Type captions in paragraph form, starting with statement of inclusive numbers.
  - Figs. 3-5. Seeds of bamboo. 3. At germination. 4. 2 wk after germination. 5. Seedlings.
  - Fig. 6. *Otatea acuminata* subsp. *aztecorum*. A. Habit. B. Flower.

### Preparation of Illustrations

- ☐ Continue page numbering.
- ☐ Illustrations are either black and white half-tones (photograph), drawings, or graphs. CONSULT EDITOR ABOUT COLOR. Reproduction in the Journal is virtually identical to what is submitted, thus you must prepare illustrations using professional standards. Flaws will not be corrected. Consult past issues of the Journal for examples.
- ☐ Because illustrations must be camera-ready, italicized words (e.g., names of species) should be italicized, not underlined.
- ☐ All artwork must be signed by the artist; unsigned artwork will be returned to the author.
- ☐ Maximum size for an illustration or plate is 217 mm x 131 mm. If placed in landscape mode, 217 mm would be the maximum width and if placed in portrait mode 131 mm would be the maximum width. Allow space for a caption if required.
- ☐ Original photographic figures and plates should be submitted in final journal size; if

submitted oversized, however, they must fit in a 10x13" envelope. Alternatively, Photomechanical Transfers (PMTs) or other "diffusion transfer process" types of high quality reductions to journal dimensions may be submitted instead of original drawings. All illustrations **MUST** have at least a 1- inch margin.

- ☐ If several photos are included, group them into one or more plates, each to consist of glossy photos butted together with no space between adjacent photos (Printer will add white separator lines). Affix with dry mount paper, or equivalent, on white posterboard, leaving at least 1" margins on all sides.
- ☐ Group several drawings to form a plate of drawings, in the same order as discussed in the text.
- ☐ Originals of laser-printed figures must be printed on the "finished" side of high-quality paper specifically designed for laser printers/electronic publishing.
- ☐ Include a scale and references to latitude and longitude on each map.
- ☐ Illustrations of highly magnified areas require a bar scale; a numerical magnification may also be included in the caption.
- ☐ Add symbols to figures with press-on symbols and letters; handwritten or typed symbols are unacceptable.
- ☐ Review copies of half-tone figures and plates must be photographic reproductions or special machine-reproduced copies approaching the quality of the originals; ordinary xerox-type copies are not acceptable.

### **Tables**

- ☐ Continue page numbering.
- ☐ Each table must start on a separate sheet, double-spaced. Use legal-size paper if necessary to allow adequate margins. Tables may be continued on extra pages if necessary; do not use small print to condense large tables onto a single page. The title should be indented and begin with the word **TABLE** (all capital letters) and number (in Arabic) followed by a period. As much as possible the title should be self-explanatory. See current issues for examples.
- ☐ Do not use footnotes; instead, add notes to the end of the table title, separated by an extra space.
- ☐ Data in tables should match those in text and keys.
- ☐ References cited in tables should be in the Literature Cited.
- ☐ Do not use vertical lines in tables.

### **Data**

- ☐ Continue page numbering.
- ☐ Data should be presented in tabular form whenever possible.
- ☐ All sequences used as data must be deposited in one of the international nucleotide sequence databases, preferably GenBank, National Center for Biotechnology Information, 8600 Rockville Pike, Bethesda, MD 20894. Email: gb-sub@ncbi.nlm.nih.gov. Request information at gsdb@gsdb.ncgr.org. Post-review final manuscript will not be accepted until sequence database accession numbers are included.
- ☐ Underline (italicize) the full name of a gene, e.g., rbcL, matK. For details on gene nomenclature, see Plant Molecular Biology Reporter 7: 266-275 (especially page 267) and 12 (2, supplement): S1-S109.
- ☐ Representative photographic figures, should be provided to document interpretations of isozymes/allozymes.
- ☐ In addition to character state distributions, consistency index, and retention index

(where appropriate), some measure of support for clades (e.g., bootstrap values, decay indices ["Bremer support"], etc.) must be provided for phylogenetic analyses.

- ☐ Indicate in MATERIALS AND METHODS the percentage of data matrix cells scored as missing data.
- ☐ When the data matrix is not part of the manuscript but is "available from the author," data must be submitted with the manuscript on diskette and in file formats which the reviewers will be able to easily use.
- ☐ Cite voucher specimens to document sources of morphological and molecular data.

### **Before Submitting**

- ☐ Have colleagues and *all authors* read the manuscript critically.
- ☐ Reprints are not supplied unless the author makes arrangements and payment to the printer. If you would like to inquire about the cost of reprints, indicate this in the cover letter.

### **Submission**

- ☐ Submit two copies of the manuscript and two copies of the illustrations.
- ☐ Do not submit original illustrations (see preparation of illustrations section).
- ☐ Provide a cover letter with the following information included: special instructions, any foreseeable changes of address for any of the authors in the next half year, phone, fax, and e-mail address for the corresponding author. Provide also names, addresses, faxes and e-mail addresses of suggested objective reviewers.
- ☐ The manuscript, tables, figure captions, and data should also be supplied in machine readable form (if possible) using MS Word, WordPerfect, or Adobe PDF.
- ☐ This completed checklist must be included.
- ☐ Submit to:       Kenneth Brennecke, Editor  
                          *Journal of the American Bamboo Society*  
                          1902 Boundary Avenue  
                          Ramona, California 92065 USA
- ☐ Any additional information and this checklist will be posted to the ABS webpage and should be consulted. Direct your browser to <<http://www.abs.org/jabs/instrcts.html>>.
- ☐ Questions should be directed to Ken Brennecke at (858) 826-4428 or (760) 788-8145; e-mail queries to [Kenneth.D.Brennecke@cpmx.saic.com](mailto:Kenneth.D.Brennecke@cpmx.saic.com).

## STATEMENT OF ORGANIZATION AND PURPOSE

The American Bamboo Society was formed on Oct. 20, 1979, in Encinitas, California, to fill a vacuum in bamboo culture and research that has existed since the U.S.D.A. stopped large scale bamboo research in 1965.

The Bambusaceae is an unusually difficult plant group to study since, typically, the plants flower only after long periods of time and are difficult to tell apart in their vegetative state. The necessity of an organization devoted to maintaining good records of as many species as possible as well as maintaining a living collection of plants of documented origin becomes obvious.

Following the examples of the Lingnan University Garden in Canton and the Fuji Bamboo Garden in Japan, it is hoped that this organization can establish a garden of several hundred bamboo species and open up research in areas that have been, so far, neglected.

The primary objectives of the organization are as follows:

1. To provide a source of information on the identification, propagation, and utilization of bamboos. To disseminate and store this information, we intend to establish a journal, a library of references, and an herbarium.
2. To promote the utilization of a group of desirable species by development of stocks of plants for distribution to botanical gardens and eventual introduction to the general public.
3. To preserve and increase the number of bamboo species in the United States. To implement this, we propose to establish a bamboo quarantine greenhouse in the San Diego area to import selected species from foreign sources.
4. To plant and maintain a bamboo garden to display characteristic beauty of mature plants and to provide a means for research in the propagation and culture of as large a number of species as possible.

---

## Contents

S. Jolly, K.R. Yadav, R.K. Sharma, R.M. Kothari and V. Ramamurthy: Response of <i>Dendrocalamus strictus</i> (Roxb.) Nees Seedlings to Soil Conditioner and Plant Growth Regulator .....	1
Phillip Stager: Bamboo and Philately.....	6
Instructions to Contributors.....	23