Laboratory Exposure Tests on Bamboo Species

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Abstract There are 500hm^2 of bamboo forest in Southern China and the output of bamboo volume is as high as 1800 tons every year. Different species of bamboo varies in their resistance to wood decay fungi. The antiseptic performance of different species of bamboo should be determined by laboratory exposure tests in order to determine and extend the application scope and scales of bamboo species.

Key words bamboo species, toxicity, laboratory exposure test

It is well known that indigenous forest resources is not able to meet the future growing demand in wood in China, especially lacking of excellent quality woods. To solve the problem, it is necessary to use other renewable and substituted resources for wood like using bamboo and plantation timbers. Bamboo is one of the most important plantation resources in Southern China. Bamboo can cost less time to be mature than other wood species, with some advantages such as excellent strength, high elastic behavior and difficult to abrade. However, bamboo has been limited in use because it contains high content of carbohydrates which make it being so susceptible to insect and fungi. To extend the application scope of bamboo, it is important to develop the preservation technology of bamboo. It is essential to understand the natural durability of different species of bamboo before it is treated with preservative. Therefore, the test on bamboo species resistant to wood decay fungi has been conducted, and the test result is summarized as follows.

1 Materials and Methods

1.1 Test materials

1.1.1 Test bamboo

13 bamboo species which can be easily found in southern China were selected for the test, including: *Gigantochloa levis×D.latiflorus Munro No.1, Bambusa pervariabilis×(D.latiflorus+B.textiles) No.1, B.chungii McClure, Gigantochloa.atter, Gigantochloa apus, B.sinospinosa McClure, B.textilis McClure, Fargesia dracocephala, Thyrsostachys siamensis(kurz ex Munro)Gamble, D.bambusoides Hsueh et Yi, Dendrocalamus brandisii, B.pervariabilis×D.latiflorus No.7* and *Dendrocalamus giganteus Munro.*

1.1.2 Test fungi

Coriolus versioolor (CV) and *Gloeophyllum trabeum* (GTR)

1.2 Test Methods

The test was carried out by following the soil block test method introduced in Chinese Standard, GB/T13942.1-92.

1.2.1 The culture of fungi

Test culture medium, maltose-agar medium, was prepared, including the following ingredients: (1) Maltose, 2g; (2) Agar, 2g; (3) Distilled water，100ml?.

The above 3 components were put in 500ml Erlenmeyer flask and sterilized at 121^{o}C for 30min. The sterilized medium was poured into sterilized Petri dishes when

it is cooled at about 60-70°C. The test fungi were then inoculated on the medium in Petri dished after it is cooled completely and cultured in the incubator at about 25°C for 7-10 days before they are used for the test.

1.2.2 Preparation of feeding samples

Feeding samples： pine wood or poplar wood， hart wood was cut into 20x20x10mm in size， the same size as test samples.

1.2.3 Preparation of soil matrix

The soil matrix was prepared, including components: (1) clean and dried sand sieved through 20-30 mesh, 20-30g; (2) Masson pine sapwood powder sieved through 20-30 mesh, 20-30g; (3) corn flour, 8.5g; (4) brown sugar, 1g. (5) 2% maltose solution 100ml.

Firstly, the components (1) to (4) were mixed equably and put into the 500ml Erlenmeyer flask to be the soil matrix for the soil block test, then 3 feeding wood samples were put on the surface of the soil matrix, and then the component (5) was added slowly into the flask, and finally the flask sealed with cotton plug was autoclaved for 1 hr before it is used for the test.

1.2.4 Inoculation of the test fungi

7-10 days old of test fungi culture on plate was inoculated on the centre of soil matrix in the flask, and then the flask was kept in the incubator with temperature of 28±2℃, and relative moisture of 75-85%.

1.2.5 The preparation of test samples

At least 12 test samples for each species of bamboo with serial number were selected and cut into about 20x20x10mm in size. Each test sample was labeled and weighted after being dried at 100±5℃ to a constant weight. Then test samples were autoclaved for about 30 min by being packed with several layer of cloth or paper to get 40 to 60 percent of moisture content before being used.

1.2.6 The inoculation of the test samples

The sterilized test bamboo sample with about 40-60% moisture content was inoculated on the top of the feeding sample which was infested and covered fully with the test fungus culture on its surface, when the surface of soil matrix was full of the growing fungus in the flask.

The flask with the test bamboo sample was kept in the incubator (28±2℃,75-80%RH) for at least 3 months before the end of the test.

1.2.6 The evaluation of the test result

In the end of the test, all test samples were taken out from the flasks and cleared away the soil matrix and fungus culture with brush, and dried at 100±5℃ to a constant temperature before they were weighted separately. Then the natural decay resistance for each bamboo species was classified based on the weight loss for each. (re. GB/T 13942.1-92)

2 Results and Discussion

The result of the laboratory exposure test is listed in Table 1. It can be seen from Table 1 that the weight loss of most species of bamboo (totaled 11 species) is less than 25% caused by brown rot fungus GTR or white rot fungus CV, and these bamboo species are belonged to decay resistance class (GB/T 13942.1-92). Only two

species of bamboo, including *B.pervariabilis×D.latiflorus No.7* and *Dendrocalamus giganteus Munro,* were caused 27% to 30% of weight loss by the two test fungi and classified into little decay resistance class (GB/T 13942.1-92).

The test bamboo did not have much change in color when it was infested by the white rot fungus CV, while it became darkening when infested by the brown rot fungus GTR. It seems as if the white rot fungus CV caused a relative higher weight loss than the brown rot fungus GTR in this test, for example, the weight loss of bamboo *Dendrocalamus brandisii* caused by CV is 10% more than that of the same bamboo species caused by GTR.

Table 1 Weight Percent Loss of Bamboo By Decay Fungi

Serial Number	Name	Weight Percent Loss by Decay Fungi		Evaluation of decay resistant
		GTR	CV	
A	*Gigantochloa levis×D.latiflorus Munro No.1*	17	19	Decay resistant
B	*Bambusa pervariabilis×(D.latiflorus+B.textiles) No.1*	18	20	Decay resistant
E	*B.pervariabilis×D.latiflorus No.7*	27	28	Little decay resistant
F	*B.chungii McClure*	21	25	Decay resistant
G	*Gigantochloa.atter*	15	16	Decay resistant
I	*Gigantochloa apus*	14	16	Decay resistant
J	*B.sinospinosa McClure*	13	17	Decay resistant
L	*Dendrocalamus giganteus Munro*	27	30	Little decay resistant
Q	*B.textilis McClure*	17	18	Decay resistant
S	*Fargesia dracocephala*	13	19	Decay resistant
T	*Thyrsostachys siamensis(kurz ex Munro)Gamble*	12	18	Decay resistant
X	*D.bambusoides Hsueh et Yi*	15	20	Decay resistant
Y	*Dendrocalamus brandisii*	12	22	Decay resistant

3 Conclusion

According to the classification method of natural decay resistant of wood introduced in Chinese Standard GB/T 13942.1-92, which based on the weight loss, the test bamboo species were classified into two different groups. Among 13 test bamboo species, 11 species were belonged to decay resistance, which included *Gigantochloa levis*×*D.latiflorus Munro No.1, Bambusa pervariabilis*×*(D.latiflorus*+*B.textiles) No.1, B.chungii McClure, Gigantochloa.atter, Gigantochloa apus, B.sinospinosa McClure, B.textilis McClure, Fargesia dracocephala, Thyrsostachys siamensis(kurz ex Munro)Gamble, D.bambusoides Hsueh et Yi* and *Dendrocalamus brandisii*, the other two species including *B.pervariabilis*×*D.latiflorus No.7* and *Dendrocalamus giganteus Munro* were belonged to little decay resistance.