SUPPRESSIVE EFFECT OF VERMI-COMPOSTED BAMBOO-POWDER ON *PYTHIUM ULTIMUM* VAR. *ULTIMUM*

X.D. You[A], Y. Shimogami[B], A. Matsumura[A] and M. Tojo[A]
[A] Graduate School of Life and Environmental Sciences, Osaka Prefecture University, Sakai City, Osaka 599 8531 JAPAN
[B] Environmental Policy Division, Kawachinagano City Office, Kawachinagano City, Osaka 586 8501 JAPAN

INTRODUCTION

Bamboo is prevailing near populated areas in Japan and cause significant impacts on diversity, terrestrial water system and carbon cycle in the ecosystem. Since bamboo contains diverse organic and inorganic nutrients, its converting into composts is a promising usage. The use of earthworms for composting organic biosolids, termed "vermicomposting", is a sustainable- and cost-effective approach for the management of biodegradable solid wastes. Commercial paper and food waste vermicomposts can suppress soil borne pathogens such as *Pythium*, *Rhizoctonia solani*, *Verticillium* (1). However, no information is available on the feasibility of bamboo vermicomposting and its suppressive effects against soil borne pathogens.

The objectives of this study were to evaluate the ability of earthworm to degrade bamboo into vegetable growth medium and to demonstrate the disease suppressiveness of the medium infested with a soil borne pathogen *P. ultimum* var. *ultimum*.

MATERIALS AND METHODS

Preparation of vermi-composted bamboo-powder

One-year-old shoots of moso bamboo (*Phyllostachys edulis* (Carrière) J. Houz.) were ground into powder using a grinder, and soaked in ten times volume of tap water for 24 hours to remove detrimental compounds such as saponin. Ten kg of the powder was mixed with 100 g of earthworm (*Eisenia fetida* Savigny), 100 g of dried powder of kudzu (*Pueraria lobata* (Willd) Ohwi.) as a nitrogen source, and 20 g of commercial horse manure/wheat straw compost (JRA Facilities, Tokyo, Japan) as a soil-microbial source. The mixture was placed in a plastic box, covered with a lid, incubated at 28±2°C for two months, and watered every other day to keep moisture at approximately 80%. Fertility properties (Inorganic N, PO_4^{3-} and K^+) of the mixture were measured by using pack tests (Kyoritsu Chemical-check Lab Co, Tokyo, Japan). A commercial nursery soil (Aisai-1, Katakura Chikkarin, Tokyo, Japan) was used as control. There were five replicates for each treatment.

Evaluation of disease suppressiveness Six-day-old seedlings of Chinese cabbage (*Brassica rapa* L. ssp. *pekinensis*, cv. Nanami) and cucumber (*Cucumis sativus* L., cv. Aonagakei-jibai), and 12-day-old seedlings of spinach (*Spinacia oleracea* L., cv. Jiromaru) grown in the commercial nursery soil were used. Inoculum of *Pythium ultimum* var. *ultimum* isolate MAFF240023 was prepared by the bentgrass-seed culture method (2). One g of the inoculum was thoroughly mixed with 100 g of the compost in a mortar and placed in a plastic pot. The seedlings were transplanted into the infested compost and grown in an incubator at 25℃ (night 12h) /28℃ (day 12h) with continuous light and irrigated daily with tap water. Mortality of the seedlings was determined 7 days after transplanting. Five pots were used for each host plant. Each pot had 5 seedlings.

RESULTS AND DISCUSSION

The vermi-composted bamboo-powder had equivalent or higher inorganic N, PO_4^{3-} and K^+ as compared to the commercial nursery soil (Table 1). The compost significantly suppressed damping-off of cucumber, Chinese cabbage and spinach (Table 2).

The equivalent or higher NPK content of the compost and its suppressiveness against *P. ultimum* var. *ultimum* indicate that the vermi-composted bamboo-powder has the agronomic potential as a vegetable growth medium.

Table 1. Fertility properties of vermi-composted bamboo -powder (VBP) and a commercial nursery soil (CNS).

	Inorganic N (mg/kg)	PO_4^{3-} (mg/kg)	K^+ (mg/kg)
VBP	440±14.7	183±48.0	752±137.0
CNS	594±19.0	240±27.7	55±1.4

Data are mean ± standard error (N = 5).

Table 2. Effect of vermi-composted bamboo-powder (VBP) and a commercial nursery soil (CNS) on vegetable damping-off caused by *Pythium ultimum* var. *ultimum* (PU).

	Mortality (%)		
	Cucumber	Spinach	Chinese cabbage
VBP+PU	0	8±4.4	0
VBP	0	0	0
CNS+PU	44.0±14.3*	80.0±5.7*	28.0±9.1*
CNS	0	0	0

Data are mean ± standard error (N = 5). Asterisk in the same column shows significant difference according the Tukey-Kramer honestly significant difference analysis (P < 0.05).

ACKNOWLEDGEMENTS

We are grateful to Dr. N. Matsumoto for his critical previewing of the manuscript. We thank the Osaka Prefectural Credit Federation of Agricultural Co-operatives for funding of this work.

REFERENCES

1. Chaoui, H., Edwards, C.A., Brickner, M., Lee, S. and Arancon, N. (2002). Suppression of the plant diseases, *Pythium* (damping off), *Rhizoctonia* (root rot) and *Verticillium* (wilt) by vermicomposts. In: Proceedings of Brighton Crop Protection Conference — Pests and Diseases, 18–21 November 2002, Brighton, U.K., vol. II, 8B-3: 711-716.
2. Tojo, M., Fujita, Y., Awad, H. M. and Ichitani, T. (1993). Preparation of *Pythium* inocula using bentgrass seeds for glasshouse studies. Proceedings of the Kansai Plant Protection Society. 35: 1-5.