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# Biological Control of Stem Rots of Oil Palms Caused by *Ganoderma Boninense* Using *Chaetomium Lucknowense* and *Chaetomium Cochiliodes*

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**Abstract** The fruiting bodies of *Ganoderma* isolate were identified as *Ganoderma boninense*. Pure cultures were isolated from samples from Thailand and from Malaysia. All tested antagonistic: *Chaetomium lucknowense* CL (C1) *Chaetomium cochiliodes* C1, C3, C4 and C5 significantly proved to inhibit or control *Ganoderma boninense* in bi-culture test at 10 days and the inhibition percentages were 63.11, 63.11,58.66,58.33 and 58.11 % respectively. It was observed that longer days of incubation period of bi-culture antagonistic plates, *Chaetomium* gave much control of *Ganoderma boninense* shown by the appearance of clear zone or inhibition zone and also the antagonistic *Chaetomium* can grow over the colony of *Ganoderma boninense* . With this, it is a good sign of control mechanism of Chaetomium that may release some antagonistic substances to suppress *Ganoderma boninense*.

**Keywords:** *Ganoderma boninense, Chaetomium lucknowense, Chaetomium cochiliodes*

## Introduction

The disease of oil palm (*Elaeis guineensis* Jacq.) caused by *Ganoderma boninense* becomes the most important disease in Thailand, Indonesia and Malaysia. Lim *et al*. (1992) stated that wilting associated with basal stem rot is the most devastating disease attacking oil palm which the pathogen is commonly found growing on the basal portion of infected palm. Turner (1981) and Steyaert (1976) reported that there are many species of Ganoderma associated with stem rot of oil palm e.g. G. applnatum (Pers.)Pat, *G. boninense*, *G. chalceum* (Cooke) Steyaert, *G. Lucidum* (W, curt. Et fr.) Karst, *G. miniatocinctum* Steyaert, *G. pseudoferreum* (Wakef) Overh. And Steinmann, *G. tornatum* (Perss.) Bres. *G. zonatum* Murrill and *G. xylonoides* Steyaert. With this, Ho and Nawawi (1985) reported that *G. boninense* was the major pathogen of basal rot of oil palms.

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Application of chemical fungicides has been recognized to cause environmental pollution and leave chemical residues in the soil, water and agricultural products, and it is known that the continuous use of chemical fungicides leads to the development of resistance in some pathogens (Soytong, 1996). Biological control of plant pathogens is a recent successful strategy for disease control and has successfully been integrated with other control measures. Biological control methods can reduce the heavy use of chemical fungicides, improving the agro-ecosystem and maintaining a natural balance (Soytong *et al*., 1999). There are several reports on the potential use of biological control agents against plant pathogens. *Chaetomium* species are strictly saprobic antagonists and have been shown to be against several plant pathogens, e.g. *Botrytis cinerea* (Kohl *et al*., 1995), *Colletotrichum gloeosporioides* (Noiaium and Soytong, 1999), *Fusarium oxysporum* f. sp. *lycopersici* (Soytong *et al*., 1999a), *Phytophthora palmivora* (Pechprome and Soytong, 1996; Sodsa-art and Soytong, 1998), *P*. *parasitica* (Usuwan and Soytong, 1998), *Venturia inegualis* (Heye and Andrews, 1983). The screening of *Chaetomium* species as biological control agents has been carried out in Thailand since 1989, resulting in the development of a biological formulation from *C*. *cupreum* CC1-10 and *C*. *globosum* CG1-12. The product has now been developed into pellet and powder formulations and registered for a Patent Right No.6266, Intl. cl. $^{5}$ AO 1 N 25 / 12 in 1994 (Soytong, 1996).

The objective of this preliminary study was to test the antogonistic Chaetomium against *Ganoderma boninense* causing basal rot of oil palms.

## Materials and methods

### *Isolation of Ganoderma boninens to pure culture*

The samples of fruit bodies infected to Oil Palm Trees were collected from Surathani Province, Thailand and Malaysia.

The pathogen was isolated by tissue transplanting technique which the fruit bodies of Ganoderma sp. was surface disinfected for 1 minute in 10% Clorox, followed by washing with sterile distilled water, then used the sterilized razor blade cut the tissue into small pieces, then transferred onto water agar, (WA) and incubated at room temperature (3o C). The mycelia growing out from the tissues were cut and transferred onto potato dextrose agar (PDA), incubated at room temperature and observed to be pure cultures.

### *Bi-culture antagonistic Tests*

Antagonistic Fungi- *Chaetomium lukcknowense* C1 and *Chaetomium cochlioildes* C2, C3, C4 and C5 were tested for biological control against *Ganoderma boninense*. The antagonistic fungi and the pathogen were cultured on PDA for 10 days , then separately cut into agar plugs at the colony margin with sterilized cock borrer which the diameter of 0.5 cm., the agar plugs of antagonist and pathogen were separately transferred onto PDA at opposite site of each other. The experiment was done by using Completely Randomized Design (CRD) with four replications. The data were collected as colony diameter (cm) and statistically computed analysis of variance. Treatment means were compared with the Least Significant Test (LSD) at P=0.05 and P=0.01.

## Results and discussions

### Isolation of *Ganoderma boninens* to pure culture

The fruit bodies of Ganoderma were identified as *Ganoderma boninense*. Pure cultures were isolated from samples from Thailand and from Malaysia.

**Fig. 1.** Fruit body of *Ganoderma boninense* infected to Oil Palm Trees in Malaysia

**Fig. 2.** Fruit body of *Ganoderma* infected to Oil Palm Trees in Thailand

**Fig. 3.** Pure culture of *Ganoderma* on potato dextrose agar at 7 days

### *Bi-culture antagonistic Tests*

Results showed that all tested antagonistic *Chaetomium lucknowense* CL (C1) *Chaetomium cochiliodes* C1 , C3, C4 and C5 were significantly proved to be inhibited or controlled of *Ganoderma boninense* in bi-culture test at 10 days which the inhibition percentages were 63.11, 63.11,58.66,58.33 and 58.11 % respectively (Tale 1 Figure 3). It was observed that longer days of incubation period of bi-culture antagonistic plates, *Chaetomium* gave a much control of *Ganoderma boninense* as the appearance of clear zone or inhibition zone and also the antagonistic *Chaetomium* can grow over the colony of *Ganoderma boninense* . With this, it is a good sign of control mechanism of *Chaetomium* that may release some antagonistic substances to suppress *Ganoderma boninense*. But it is clearly demonstrated that the biological product of Chaetomium gave a good control of *Thielaviopsis* Bud Rot of Bottle Palm

(*Hyophorbe lagenicaulis*) in Thailand. . In the field, the five year old Bottle Palms completely recovered from disease when *Chaetomium* biological product was applied to infested soil at the rate of 20 g/plant. Antagonistic substances produced by *C. cupreum* and *C. globosum* were sprayed to control terminal bud rot and integrated with other cultural control measures. The treated trees recovered significantly within 30 days of application and new leaves emerged. The *Chaetomium* biological product has good potential in the control of Bud Rot of Bottle Palm (Soytong *et al*., 2005).

**Table 1.** Colony diameter (cm) of *Ganoderma boninense* in bi-culture antagonistic tests in Petri Dishes at 15 days

| Treatments | R1 | R2 | R3 | R4 | average | Inhibition (%) |
|---|---|---|---|---|---|---|
| Pathogen | 9.00 | 9.00 | 9.00 | 9.00 | 9.00a | - |
| Chaetomium1 | 3.20 | 3.20 | 3.40 | 3.50 | 3.32c | 63.11 |
| Chaetomium2 | 3.40 | 3.30 | 3.20 | 3.40 | 3.32c | 63.11 |
| Chaetomium3 | 3.50 | 3.60 | 3.80 | 4.00 | 3.72b | 58.66 |
| Chaetomium4 | 3.90 | 3.80 | 3.70 | 3.60 | 3.75b | 58.33 |
| Chaetomium5 | 3.80 | 3.50 | 3.80 | 4.00 | 3.77b | 58.11 |

[1] Means follow by a common letter are not significantly different by Duncan Multiple Range Test (DMRT) at P=0.01, C.V. = 3.40 %.

[2] Percent Inhibition (PI) = colony diameter of pathogen in control plate – colony diameter of pathogen in bi-culture plate/ colony diameter of pathogen in control plate X 100.

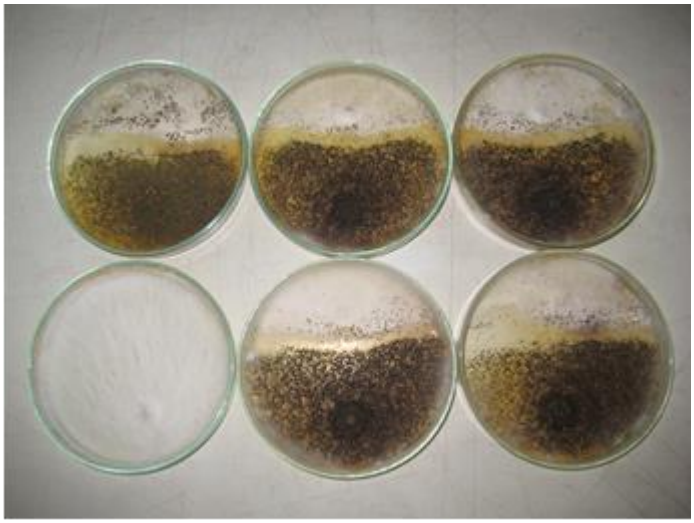

**Fig. 3.** Bi-culture antagonistic *Chaetomium* spp against *Ganoderma boninense*

### *Further investigation*

Biological fungicide were formulated and developed as powder form. The formulation is currently being tested to control white root disease of oil palm trees in the fields.

## References


Heye, C. C. and Andrews, J. H. (1983). Antagonism of *Athelia bombucina* and *Chaetomium globosum* to the apple scab pathogen, *Venturia inequalis*. Phytopathology 76:650-654.

Ho, Y. W. and Nawawi, A. (1985). Ganoderma boninense Pat from basal stem rot of oil palm (*Elaeis guineensis*) in Peninsular Malaysia. Pertanika 8:425-428.

Kohl, J., Molhoek, W. M. L., Van Der Plas, C. H. and Fokkema, N. J. (1995). Effect of *Ulocladium atrum* and other antagonistics on sporulation of *Botrytis cinerea* on dead lily leaves to field conditions. Phytopathology 85:393-401.

Lim, T. K., Chung, G. F. and Ko, W. H. (1992). Basal Stem Rot of oil palm caused by *Ganoderma boninense*. Plant Protection Bulltin 1:147-152.

Noiaium, S. and Soytong, K. (1997). Integrated biological control of mango var. Choakanon. Proceedings of the Sixth International Mango Symposium. Pattaya, Thailand. pp. 1-13.

Sodsa-art, P. and Soytong, K. (1999). Biological control of black pepper root and basal stem rot in the field. Proceedings of Symposium on Biological Control in the Tropics, MARDI Training Centre, Malaysia. pp. 68-70.

Soytong, K. (1991). Species of *Chaetomium* in Thailand and screening for their biocontrol properties against plant pathogens. Proceedings of the XII International Plant Protection Congress. 11-16 August 1991, Rio de Janeiro, Brazil.

Soytong, K. (1992). Biological control of rice blast disease by seed coating with antagonistic fungi. Songklanakarin Journal of Science and Technology 14:59-65.

Soytong, K. (1995). *Chaetomium* as a biocontrol agent against plant pathogens. Proceedings of the XIII International Plant Protection Congress, 2-7 July 1995, The Hague-The Netherlands.

Soytong, K. and Soytong, K. (1996). *Chaetomium* as a new broad spectrum mycofungicide. Proceedings of the First International Symposium on Biopesticides, Thailand. pp. 124-132.

Soytong, K., Jindawong, N. and Yang, Q. (1999). Evaluation of *Chaetomium* for biological control of *Fusarium* wilt of tomato in P.R. China. Proceedings of the 5th International Conference on Plant Protection in the Tropics, 15-18 March 1999, Malaysia. pp. 484-487.

Soytong, K., Pongak, W. and Kasiolarn, H. (2005). Biological control of *Thielaviopsis* bud rot of *Hyophorbe lagenicaulis* in the field. Journal of Agricultural Technology 1:235-245.

Soytong, K., Usuwan, P., Kamokmedhakul, S., Kanokmedhakul, K., Kukongviriyapan, V. and Isobe, M. (1999). Integrated biological control of *Phytophthora* rot of sweet orange using mycofungicides in Thailand. Proceedings of the 5th International Conference on Plant Protection in the Tropics, 15-18 March 1999, Malaysia. pp. 329-331.

Steyaert, R. L. (1967). Les Ganoderma palmicoles. Bulletin du Jardin botanique national de Belgique/Bulletin van de National Plantentuin van Belgi ë 37:465-492.

Turner, P. D. (1981). Oil palm diseases and disorders. Oxford Univ. Press.

Usuwan, P. and Soytong, K. (1998). Biological control of Phytophthora rot of citrus in the field. Proceedings of the 24th Congress on Science and Technology. pp. 19-21.


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