

## **Research on Utilization Metavina 80LS to Treat *Odontotermes hainanensis* (Isoptera: Macrotermitinae) Damaging Dikes**

by

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### **Abstract**

Research on utilization Metavina 80LS to treat *Odontotermes hainanensis* has shown that 100% of termite nests on the Ta Day dike (Hanoi city) which were treated with the formulation of Metavina 80LS, completely died after 20 days treatment.

**Key words:** Metarhizium, Metavina 80LS, *Odontotermes hainanensis*

### **Introduction**

*Odontotermes hainanensis* Shiraki is a popular termite dangerous for dike in Vietnam and China. Density of this termite's nest makes up 46.2% number of termite's nest dangerous for system of dams in Hanoi (Bui Cong Hien et.al, 2000). The current applicable treatment technology for this termite is to define location of termite's nest, bore into main chamber to pour termite control chemical and then inject mortar to cover their system of empty cavities. Although, chemical used for controlling is usable permitted type, it impacts more and less on the environment. Thus, the research on using biological products to effectively control this type of termite without impact on the environment is a practical and urgent request.

Our laboratory research result shows that forms of *Metarhizium* products are effective for the termite control. *O.hainanensis* with name of Metavina 80LS used for controlling termite's nests in field conditions has not been announced in the country or foreign countries yet. The testing result of Metavina 80LS product for *O.hainanensis* termite's nests in K54 – 65.5 Ta Day dike, Hanoi, thus, are considered as first announced data.

### **Materials and methods**

#### **Materials**

Suspended *Metarhizium* product is a mixture of *Metarhizium* spores in water, supplemented with 2% tween 80.

Submerged *Metarhizium* (Metavina 80LS) is the product obtained after the fermentation of *Metarhizium anisopliae* in liquid medium. After cultivation, retrieve the biomass by filtration through the Whatman filter paper.

Piles of wood, hoes, shovels, pipe lines, air compressors, the average jet ...

Vibratory spiral and other equipment used in handle termite nests of the Institute for Termite control and works protection.

#### ***Nest detection method***

Based on signs made by termites on surface of ground (swarming holes, exit holes, tube system...), so that nest area can be located.

Using Ground Penetrating Radar with frequency of 100MHz and 200MHz to identify the main chamber of the nest.

#### ***Termite's nest treatment method by Metavina 80LS***

Use vibratory spiral borer to create boreholes 6.4 cm in diameter in main chamber of termite's nest.

Metavina 80LS product is mixed into water with dose of 5l Metvina 80LS/100l of water.

Pour Metavina 80LS solution into termite's nest through boreholes until the nest is filled.

Compare by conducting the same way but only water without Metavina 80LS product.

#### ***Termite's nest treatment method by suspended Metarhizium product***

Use vibratory spiral borer to create boreholes 6.4 cm in diameter in main chamber of termite's nest.

Suspended *Metarhizium* product used is produced by giving 0.5 kg; 0.75 kg and 1 kg of *Metarhizium* spore in 100l of 2% Tween80-available water.

Pour each suspended *Metarhizium* product into termite's nest through boreholes until the nest is filled.

Compare by conducting the same way but wheat flour in stead of *Metarhizium*.

#### ***Result test method***

Test activity sign of termite through boreholes on the fifth, the tenth and the fifteenth after the date of treatment.

After 20-day treatment, conduct to dig termite's nest to test result of termite control of the tested *Metarhizium* product. The effect of termite control is based on some factors such as termite's activity in main chamber of the nest, dead bodies of termite springing up with *Xylaria* and grass-root growing in chambers of termite's nest.

#### ***Location and time study***

Nests of *Odontotermes hainanensis* in the reproductive season with the range of 20 to 25 swarming holes of each were prepared for experiment.

Time study was conducted from late February to early June 2006

Research sites in K54 – 65.5 Ta Day dike, Hanoi.

## **Results and discussion**

#### ***Test result of suspended Metarhizium product***

The result in table 1 shows that although being poured water and suspended product in the nest, activity of the majority of termite's nest in compared batch and tested batch is normal. In details, termite workers closely cover boreholes and swarming holes, termite moves around again and again in muds. As

for product-poured termite's nests, there are most spore, activity of termite shows attenuation much in first stage, but in next stage, their activity is recovered.

When digging termite's nest, we find some dry dead bodies of termite on the swarming holes and gallery system, but in the chambers, there is not dead body of termite found, number of alive termites is big, *Termitomyces* fungus is normal. These appearances prove that the suspended *Metarhizium* product remarkably affects to the termite's nest or not. Maybe it may affect to some individuals acting outside the chamber.

Table 1. Result of using suspended *Metarhizium* product for controlling *O. hainanensis* in dikes

Checking time (day)	Treatment			Control		
	Spore (kg)/100l water			Wheat flour (kg)/100l water		
	0,5	0,75	1,0	0,5	0,75	1,0
5	+++	++	++	+++	++	++
10	+++	+++	++	+++	+++	+++
15	+++	+++	+++	+++	+++	+++
20	+++	+++	+++	+++	+++	+++

Notes: Termite nests activity as normal: +++ Termite nests activity decline: ++

This result shows that *Metarhizium* spore can not germinate in the chambers having *Termitomyces* fungi garden of the termite's nest and thus, it can not parasitize on alive termites in these cavities.

**Test result of *Metavina 80LS* product**

Results after 20 days treatment of 25 termite nest in Km54 – 65.5 Ta Day dike, Hanoi has shown in table 2

Table 2. Result of using *Metavina 80LS* for controlling *O. hainanensis* in dike

Treatment	Treated nest	Contained xylaria	Results			
			Nests out of termite	Percent (%)	Remaining termites in sub-chamber	Percent (%)
<i>Metavina 80LS</i>	22	15	19	86,4	3	13,6
Water	3	0	0	0	0	0

Following the experiment, we found that 100% of perforated termite nest treated with *Metavina 80LS* after 5 days were not filled while those not treated were filled. After 10 to 15 days treated, we did not collect termites in the chimney of nest treated while termites in the nest not treated still acitived as usual. The most striking point from the table is that, we found *Xylaria* hyphae covering on the grass of 15 among treatment nest with the percentage of 68.2%. *Xylaria* fungi have been known as the indicator

of death of *Odontotermes* and *Macrotermes* genus. This phenomenon did not see in the nest treated with chemical we usually did before.

By digging and operating on some nests treated with Metavina 80LS, we found some strange phenomena. The hyphae system of *Metarhizium anisopliae* fully covered all major as well as sub-chamber of fungus garden of *Termitomyces* and made the fungus garden structure collapsed. At some positions, *Metarhizium anisopliae* mycelium reproduced spore with typical colour of dark-blue. The corpse of termite infected by *Metarhizium anisopliae* concentrated into mass on the passage caves or in the fungus garden of sub-chamber. Root of weed grew densely on the wall of the main chamber or sub-chamber (fig 1 and 2). And that was a sharp distinction compared with control nest walls which were smooth with no weed roots. In the main chamber, *Xylaria* germinating from corpse of *Termitomyces* fungus garden, shot up from the head of nests and covered the grass layer on the ground. In operation on the corpse of *Termitomyces* fungus garden, we did not find living termites, but only dry worker and soldier corpses killed by *Metarhizium anisopliae*. However, in 3 nest, some sub chambers lying high and away from the main chamber, living termites were found in the top half while *Metarhizium anisopliae* were growing in the lower half. In the control plots, termites stayed normal.



Fig 1. *O. hainanensis* alates death in sub-chamber 20 days after treatment with Metavina 80LS



Fig 2. Observed *Xylaria* germinating at central chamber of *O. hainanensis* 20 days after treatment with Metavina 80LS

Observations at the 3 control plots showed, pumping water with volume of 100l almost did not significantly affect termite behavior.

Out of 22 treated nests, 19 saw the complete death of termites, accounting for 86,4%; in the 3 remaining nests only a few termites survived but they were quite weak because of degradation in sub chambers close to dyke face. Thus, those nest can hardly maintain and return to normal.

Results showed that although both suspended *Metarhizium* and Metavina 80LS are produced from *Metarhizium anisopliae* but their effectiveness for controlling *Odontotermes hainanensis* termite are different.

The difference on the effective of termite control between two products can be explained as follows: fermentative liquid of *M. anisopliae* consists of mycelium biomass, plastospores, submerged conidia, over 25 types of destruxins and exoenzymes like: endoprotease, aminopeptidase, carboxypeptidase A, lipase... (Leger et al., 1986). These exoenzymes play an important role in the effectiveness of Metavina 80LS in termite control. The exoenzymes can inhibit the growth and development of fungus garden in *Odontotermes hainanensis* colony leading to the degradation of fungus and ecidioclimate change in the nest. Besides, the destruxins weaken the termites and create favourable condition for germination of hyphae and spores contained in Metavina 80LS, infecting the whole colony. This may be the result of pathogenous mechanism of fermentative liquid of *Metarhizium anisopliae* (Metavina 80LS) used on termite species containing fungus garden.

### Conclusions

Suspended *Metarhizium* product can not eliminate the *Odontotermes hainanensis* in dike.

Metavina 80LS significantly takes effect on controlling *Odontotermes hainanensis* in dike with a dose of 5l Metavina 80LS/100l water.

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