

TRAP FOR AUTO-DISSEMINATION OF *Metarhizium* FOR THE CONTROL OF *Oryctes rhinoceros*

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The entomopathogenic fungus, *Metarhizium anisopliae* is one of the pathogens of the rhinoceros beetle, *Oryctes rhinoceros* (Latch, 1976). Effective control of the beetle is achieved by drenching the spore solution or broadcasting the growing substrates of the pathogen onto the breeding sites of the beetle (Ramle *et al.*, 1999). The fungus infects all stages of the *Oryctes*, including the adults. Taking the advantage of adult migratory behaviour, they can be used as an effective carrier to disseminate the pathogen into the natural habitats of the *Oryctes*.

DISSEMINATION PROCESS

The trap consists of a pheromone lure, compartments with specific functions and the spores of *Metarhizium* formulated in the liquid form (Figure 1). The attracted adult beetles will collide with the trap's vane and fall into a disc, where the spores of the pathogen are placed. As the adults crawl, they will be exposed to the pathogen. The trap design allows the adults to escape from the trap and carry the pathogen into the natural habitat of the beetles. This pathogen will then spread to the other healthy immature and adult stages when the infected adult dies and subsequently become an inoculum source of the pathogen.

TRAPPING EFFICIENCY

The efficiency of the inoculation trap in capturing the adults was compared with a commercial pail trap (Table 1). The results showed that the adult captures in the inoculation traps were comparable with the capture of commercial pail traps.

EFFICIENCY OF TRAP IN INFECTING ADULTS

Test was conducted by placing the traps which contained the liquid formulated spores in the field. The trapped adults were collected daily and reared in the laboratory until 30 days. The results showed that 10 out of 15 trapped adults or 66.7% were confirmed dead with *Metarhizium* infection (Table 2).

PERFORMANCE OF ADULT BEETLES IN THE DISSEMINATION OF PATHOGEN

The performance of infected adult beetles in the dissemination of the pathogen to healthy third instar larvae of *Oryctes* was evaluated in the laboratory. Field collected adults were inoculated with *Metarhizium* by soaking them in a spore solution (4 g spores/litre⁻¹) for 30 s, then placing them in a container for 5 min. The inoculated adults were then introduced into a plastic box half filled with rotting materials, which contained 12 *Oryctes* larvae. Two application rates, two and four inoculated adults per box were tested. Data on mortality and infection of both the inoculated adults and larvae were recorded two weeks after treatment.

The *Metarhizium* caused as high as 100% mortality with 63% to 69% infection to the *Oryctes* adults (Table 3). Introduction of inoculated adults at both two and four adults per box caused 100% larval mortality with the infection levels as high as 91.7%.

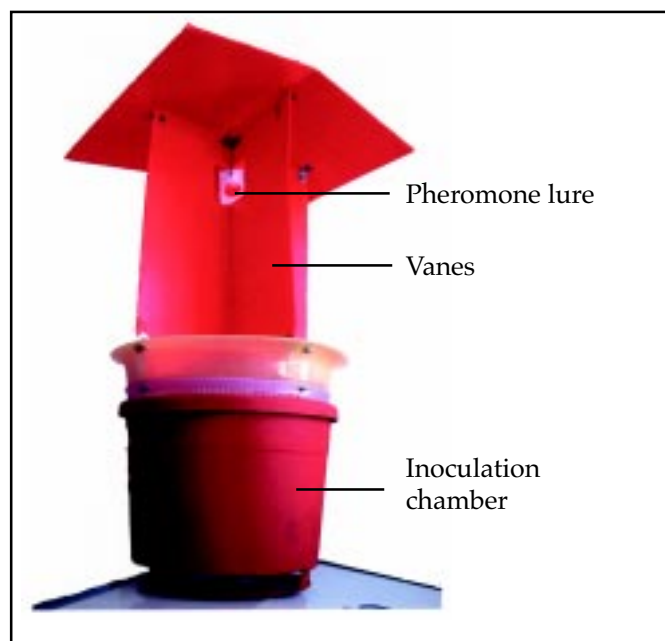


Figure 1. Prototype of the inoculation trap.

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TABLE 1. THE EFFICIENCY OF INOCULATION TRAP AS COMPARED TO STANDARD PAIL TRAP IN CAPTURING THE BEETLE ADULTS IN THE FIELD

Type of trap	Period of trapping (days)	No. of traps tested	Total capture	Mean capture (adults trap ⁻¹ day ⁻¹)	T-test
Inoculation trap	10	16	135	2.48	ns
Pail trap	10	6	47	2.35	

Note: ns, Means of capture are not significantly different ($P>0.05$).

TABLE 2 . MORTALITY OF ADULT BEETLES AFTER ENTERING THE INOCULATION TRAP THAT CONTAINED LIQUID FORMULATION OF *Metarhizium*

Treatment	Total capture	Number of adults dead over time (days after trapping)					Total dead	Total infected
		6	12	18	24	30		
<i>M. anisopliae</i>	15	0	9*	1*	1	1	12	10*
Control	11	2	3	0	2	1	9	0

Note: *Number of dead adults infected by *Metarhizium*.

TABLE 3. THE PERFORMANCE OF INFECTED ADULTS DISSEMINATING THE *Metarhizium* TO THE LARVAE OF *Oryctes*

Treatment (inoculated adults/box)	Adult/box	Adults			Larvae		
		Tested (N)	Mortality (%)	Infected (%)	Tested (N)	Mortality (%)	Infected (%)
T1 (2)	2	8	100.0 ^a	62.5 ^a	48	100.0 ^a	91.7 ^a
T2 (4)	4	16	87.5 ^a	68.5 ^a	48	100.0 ^a	91.7 ^a
Ctr (0)	4	12	16.7 ^b	0.0 ^b	48	45.6 ^b	0.0 ^b

Note: Means in columns with the same letters are not significantly different by Duncan Multiple Range Test ($P>0.05$).

CONCLUSION

The use of *M. anisopliae* as a biocontrol agent for *Oryctes* is safe to the environment and non-targets organisms. The inoculation trap makes dissemination of the pathogens in the field simple and easy. The trap compartments are specifically designed to protect the pheromone and the pathogen from detrimental abiotic factors, which prolong the life span of both products.

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