



Research Note

Relative safety of *Beauveria bassiana* (Bb 112) oil formulation to *Cryptolaemus montrouzieri* Mulsant

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ABSTRACT: Biopesticides are promising alternatives to chemical pesticides, and they have opened up new panorama in insect pest management to aid in the promotion of safe, eco-friendly pest management. They are relatively host specific and do not interfere with other biotic systems. Research concerning the development of biopesticides has focused mainly on identification of virulent isolates of bioagents for effective management of the target pests. However, information pertaining to their effects on natural enemies, non-target pests, and environment is scanty. In the present study, oil formulation of fungal pathogen, *Beauveria bassiana* (Bb 112) was tested against adults of *Cryptolaemus montrouzieri* Mulsant (Coleoptera:Coccinellidae), under laboratory condition. Oil formulation of *B. bassiana* (Bb 112) has been found to be safer to *C. montrouzieri* adults with maximum adult survival of 92.62 per cent at the highest dose (10^8 spores ml^{-1}) and 100 per cent survival at lower dose tested (10^4 spores ml^{-1}) respectively.

KEY WORDS: Adult survival, biopesticide, Bb 112, *Cryptolaemus montrouzieri*, safety

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INTRODUCTION

In the present agrarian scenario, safer and eco-friendly pesticides are imperative to counter pest maladies in crop ecosystem. Insecticide resistance in insects and increasing deleterious effects of agro chemicals on the environment and human safety forced the search for alternatives in pest management. It is well documented that use of microbial control agents in integrated management of insect pests is a viable option (Ujjan and Shahzad, 2012; Erler and Ates, 2015) While the use of insecticides remains an important component of Integrated Pest Management (IPM), biological suppression of insect pests is also considered as an equally important tool. Hence, the protection and preservation of natural enemies of the pests are essential.

Fungal pathogens are one of the potent agents against insect pests. Among them, *Beauveria bassiana* is an ideal candidate in insect pest suppression (Aherkar *et al.*, 2006; Shi *et al.*, 2008; Akmal *et al.*, 2013; Wu *et al.*, 2013). In this background, efficacy of *B. bassiana* (Bb 112) (Sangamithra, 2015) oil formulation was tested against mealybug *Ferrisia virgata* Ckll. in tomato and it was found to be effective. The indiscriminate use of insecticides has affected the population of biocontrol agents, as all the conventional recommended insecticides are highly toxic to predators and parasitoids (Dhawan *et al.*, 1992; 1994; Singh, 1994).

The population of predators has declined by 68.40 per cent during the last two decades and many parasitoids have been eliminated (Dhawan and Simwat, 1996). The Australian ladybird beetle, *Cryptolaemus montrouzieri* Mulsant (Coleoptera: Coccinellidae) is predatory on a wide range of mealy bugs. It is native of Australia and was introduced in India in 1898 for control of the coffee green scale. The biological suppression of mealy bugs through this potent predator in India has been well documented (Mani *et al.*, 1995). However there is a necessity to study the relative safety of any pesticide used for management practices. The objective of the present study was to assess the safety of *B. bassiana* (Bb112) oil formulation against adults of *C. montrouzieri* under laboratory condition.

Laboratory experiments were carried out at Insectary, Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore during 2016 to study the safety of *Beauveria bassiana* oil formulation (Bb 112) to adults of *Cryptolaemus montrouzieri*. The grubs of *C. montrouzieri* were obtained from National Bureau of Agricultural Insect Resources, Bengaluru and mass reared under laboratory condition.

Mealybugs (*Maconellicoccus hirsutus* Green) were collected from the fields and released onto the pumpkin. After 15 days of

infestation of pumpkins with bugs they were exposed to a set of *Cryptolaemus montrouzieri* grubs. Young grubs fed on eggs and small mealy bugs but as they grew, they became voracious and fed on all stages of mealy bugs. For facilitating pupation of grubs, dried guava leaves or pieces of papers were kept at the base of each cage. From the mass culturing cages, adults were collected for experiments.

Fungal spores of *Beauveria bassiana* (Bb 112) were used for the preparation of oil formulation of Bb 112 by adopting the protocol standardized by Sangamithra (2015) and stored at room temperature for experiments. The bioassay method described by McCutchen and Plapp (1988) was adopted. Five concentrations of oil formulation of *B. bassiana* (Bb 112) using water were prepared. A drop of Tween 80® was added as surfactant. These concentrations were evenly coated in the glass scintillation vials of 20 ml capacity and dried thoroughly for 15 minutes. *Cryptolaemus montrouzieri* adults were released at the rate of thirty per vial and covered with untreated muslin cloth. Vials coated with oil without fungal spores were maintained as control. After one hour of exposure, the adults were transferred to plastic boxes of 50 ml capacity and closed with perforated lid and mealy bugs collected from guava fields were given as feed. Four replicates were maintained. The observations were made on the survival of adults and the per cent adult survival was worked out as follows and given in Table 1.

$$\text{Percent adult survival} = \frac{\text{Number of live adults}}{\text{Total no. of adults released}} \times 100$$

The data on number of adults survived were analysed in completely randomized design and transformed into $\sqrt{X+0.5}$ before

statistical analysis. The mean values were separated using Latin Square Design (LSD). The corrected per cent mortality was worked out using the Abbott's formula (Abbott, 1925).

$$\text{Where, Corrected per cent mortality} = \frac{Po - Pc}{100 - Pc} \times 100$$

Po - Observed mortality in treatment

Pc - Observed mortality in untreated check

Results from the experimental study showed that oil formulation of *Beauveria bassiana* (Bb 112) had less effect on *Cryptolaemus montrouzieri* adults with maximum adult survival of 92.62 per cent at the highest dose (10^8 spores ml⁻¹) of Bb 112. At lower doses, there was no effect on *C. montrouzieri* adults and survival was 100 per cent. The present findings were in agreement with Thungrabeab and Tongma (2007), who reported that *B. bassiana* Bb.5335 and *Metarhizium anisopliae* Ma.7965 have the potential to be used as biological control agents against insect pests because they were relatively safe on non target insects such as natural enemies *viz.*, *Coccinella septempunctata* L., *Chrysoperla carnea* (Stephens) and *Dicyphus tamaninii* Wagner and beneficial soil insect *Heteromurus nitidus* Templeton. The present findings were also in accordance with Brown and Khan, (2009) who reported that *M. anisopliae* isolate was safe against *C. montrouzieri*.

Hence the oil formulation of *Beauveria bassiana* (Bb 112) was relatively safe at the concentrations tested under laboratory condition. Whereas, under field conditions, due to climate, the

Table 1. Relative safety of oil based formulation of *Beauveria bassiana* (Bb 112) to *Cryptolaemus montrouzieri* adult

Treatment	Dose	Adult survival (Nos)* DAT (N = 30)							Adult survival (%)
		1	2	3	4	5	6	7	
Oil based formulation of <i>B. bassiana</i> (Bb112)	10 ⁴ spores ml ⁻¹	30.00 (5.52)	30.00 (5.52) ^a	30.00 (5.52) ^a	30.00 (5.52) ^a	30.00 (5.52) ^a	30.00 (5.52) ^a	30.00 (5.52) ^a	100.00
	10 ⁵ spores ml ⁻¹	30.00 (5.52)	30.00 (5.52) ^a	30.00 (5.52) ^a	30.00 (5.52) ^a	30.00 (5.52) ^a	30.00 (5.52) ^a	30.00 (5.52) ^a	100.00
	10 ⁶ spores ml ⁻¹	30.00 (5.52)	30.00 (5.52) ^a	30.00 (5.52) ^a	29.50 (5.48) ^a	29.00 (5.43) ^a	29.00 (5.43) ^b	29.00 (5.43) ^b	98.33
	10 ⁷ spores ml ⁻¹	30.00 (5.52)	30.00 (5.52) ^a	30.00 (5.52) ^a	27.50 (5.29) ^b	26.75 (5.22) ^b	26.75 (5.22) ^c	26.75 (5.22) ^c	94.17
	10 ⁸ spores ml ⁻¹	30.00 (5.52)	28.75 (5.41) ^b	28.00 (5.34) ^b	27.50 (5.29) ^b	26.75 (5.22) ^b	26.75 (5.22) ^c	26.75 (5.22) ^c	92.62
	Oil without <i>B. bassiana</i> spores	30.00 (5.52)	30.00 (5.52) ^a	30.00 (5.52) ^a	30.00 (5.52) ^a	30.00 (5.52) ^a	30.00 (5.52) ^a	30.00 (5.52) ^a	100.00
SE (d)		NS	0.00	0.04	0.08	0.02	0.03	0.03	
CD(P = 0.05)		-	0.00	0.09	0.17	0.04	0.08	0.08	

In a column, means followed by the common letter(s) are not significant in LSD @ 5% level of significance

* Mean of four replications; Values in the parentheses are square root transformed

DAT – Days after treatment

product reaching the beneficial organism may be much limited. Hence, further studies are required to increase the potency of such formulations under field conditions.

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