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Management of sorghum army worm, *Mythimna separata* (Walker) (Lepidoptera: Noctuidae) using biopesticides

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ABSTRACT: A field experiment was conducted for two years (2002-03 and 2003-04) to manage armyworm, *Mythimna separata* (Walker), on sorghum with biopesticides, *viz.*, *Nomuraea rileyi* (Farlow) Samson and *Ms*NPV, and compared with poison bait and chemical control. Spray of *N. rileyi* at both the doses, *viz.*, 1×10^8 and 2×10^8 conidia l^{-1}, were found to be effective in checking the larval population. The highest yield of 21.14 q ha^{-1} was obtained in *N. rileyi* spray at 2×10^8 conidia l^{-1} and was on par with *N. rileyi* spray at 1×10^8 conidia l^{-1}. The maximum cost-benefit ratio of 1: 36.45 was obtained in *N. rileyi* spray at 1×10^8 conidia l^{-1} followed by *N. rileyi* spray at 2×10^8 conidia l^{-1} with a CB ratio of 1: 29.44.

KEY WORDS: Armyworm, cost-benefit ratio, *Mythimna separata*, *Ms*NPV, *Nomuraea rileyi*, sorghum

The armyworm, *Mythimna separata* (Walker) (Lepidoptera: Noctuidae), is polyphagous and one of the serious pests of cereal crops, mainly sorghum, maize and sugarcane in Karnataka (Kulkarni and Jotwani, 1978). Severe epidemics of this pest resulted in up to 100 per cent damage in transitional belt during 1988-89 (Anonymous, 1989) at Dharwad with a maximum population of 35 larvae per plant on sorghum. The present management strategies aim at only use of chemical insecticides (Hiremath *et al.*, 1990), which pose a threat to human beings, domestic animals and wildlife by causing environmental pollution. Apart from this, application of chemicals in tall crops like sorghum is hazardous to the applicator. Hence, a study was made to evaluate biopesticides as they are ecofriendly, effective, mass multiplied under laboratory condition, stored and made available to the end users whenever it is required. Perusal of literature revealed that there is no work on armyworm with *Nomuraea rileyi* (Farlow) Samson. However, its natural epizootics on *Mythimna (Pseudaletia) unipuncta* (Haw.) in rice ecosystem have been reported in India by Ambethgar and Kumaran (1998). The natural incidence of *Nomuraea rileyi* on *Helicoverpa armigera* (Hubner) and *Spodoptera litura* (Fabricius) was reported by Patil (2000) in groundnut ecosystem at Dharwad. This investigation deals with the management of this pest with biopesticides.

The experiment was conducted at University of Agricultural Sciences, Dharwad, during 2002 – 2004 on sorghum (Var: CSH-9) raised in 11 rows, each 4m long spaced at 45cm. Each row consisted of 27 plants. The plot size of each treatment was

5.4mx4m. The crop was protected from all pests and diseases by following the recommended plant protection schedule except for armyworm. Soil application of carbofuran 3G @30 kg ha^{-1} was done at the time of sowing for the management of shoot fly. The experiment was laid out in completely randomized block design comprising five treatments and five replications. The facultative fungus *N. rileyi* was tested for its pathogenicity to *M. separata* at two dosages, *viz.*, 1x10^{8} conidia l^{-1} and 2x10^{8} conidia l^{-1} and compared with *Ms*NPV 250LE ha^{-1}, poison bait (50 kg rice bran, 2 kg jaggery, 250ml monocrotophos and 6 l of water per hectare) and endosulfan @ 0.07% spray under field condition. The treatments were imposed only once at 50-55 days after sowing. Observations were made on the number of larvae per plant a day before and 10 days after application. The data were subjected to statistical analysis after square root transformation (x+1). The data on yield was noted from each treatment and finally cost-benefit ratio was worked out. The gross return, net return and the actual expenditure made in each treatment towards the management of armyworm were calculated. Based on this, the cost-benefit ratio was worked out.

There was no significant difference among the treatments before imposing the treatments indicating the uniformity in pest pressure during both the years. The number of larvae per plant after spray was least in the treatment *N. rileyi* (2x10^{8} conidia l^{-1}), followed by spray of *N. rileyi* @ 1x10^{8} conidia l^{-1} (during 2002-03). However, these two treatments were on par with each other. The treatments *Ms*NPV @ 250LE ha^{-1} and poison bait recorded 0.83 and 0.81 larvae / plant, respectively, and were found to be equally effective in the management of *M. separata*, but differed significantly from *N. rileyi* sprays at both the dosages and also chemical control by endosulfan spray (0.07%). During 2003-04, *N. rileyi* sprays at both the dosages emerged as the best treatments by recording the least number of larvae per plant. These two treatments were found to be

Table 1. Management of *Mythimna separata* using biopesticides

Treatment	No. of larvae / plant				
	Before spray		After spray		
	2002-03	2003-04	2002-03	2003-04	Mean
Spray *N. rileyi* @ 1x10^{8}conidia l^{-1}	2.71^{a} (1.92)	2.61^{a} (1.90)	0.61^{a} (1.26)	0.57^{a} (1.25)	0.59^{a} (1.26)
Spray *N. rileyi* @ 2x10^{8}conidia l^{-1}	2.80^{a} (1.95)	2.68^{a} (1.91)	0.56^{a} (1.24)	0.50^{a} (1.22)	0.53^{a} (1.23)
MsNPV @ (250LE ha^{-1})	2.74^{a} (1.93)	2.64^{a} (1.90)	0.83^{b} (1.35)	0.78^{b} (1.33)	0.81^{b} (1.34)
Poison bait	2.75^{a} (1.93)	2.65^{a} (1.91)	0.81^{b} (1.34)	0.77^{b} (1.33)	0.79^{b} (1.33)
Endosulfan @ (0.07%)	2.81^{a} (1.95)	2.69^{a} (1.92)	0.75^{b} (1.32)	0.70^{b} (1.30)	0.72^{b} (1.31)

* Means followed by the same alphabet do not differ significantly (P = 0.05) by DMRT; figures in parentheses are square root transformed values (x+1)

Table 2. Yield and cost benefit ratio of biopesticide treatments for the management of *M. separata*

Treatment	Yield q / ha			C: B ratio
	2002-03	2003-04	Mean	
Spray *N. rileyi* @ 1 x 10^8conidia l^{-1}	25.12[a]	15.02[a]	20.07[a]	1:36.45
Spray *N. rileyi* @ 2 x 10^8conidia l^{-1}	25.22[a]	15.05[a]	20.14[a]	1:29.44
MsNPV @ (250LE ha^{-1})	23.35[b]	13.33[b]	18.35[b]	1:6.82
Poison bait	23.15[b]	13.14[b]	18.15[b]	1:9.53
Endosulfan @ (0.07%)	25.03[a]	14.85[a]	19.95[a]	1:10.68

* Means followed by the same alphabet do not differ significantly (P = 0.05) by DMRT; figures in parentheses are square root transformed values (x+1)

on par with each other and differed significantly from the rest of the treatments. The pooled analysis over two years indicated a similar trend (Table 1).

The mean maximum yield of 20.14q ha^{-1} over two years was obtained by the application of *N. rileyi* @ 2x10^8 conidia l^{-1}, closely followed by *N. rileyi* 1x10^8 conidia l^{-1}, both on par with each other. These two treatments outyielded and differed significantly from the rest of the treatments. Maximum C: B ratio of 1: 36.45 was obtained with *N. rileyi* @ 1x10^8 conidia l^{-1}, followed by *N. rileyi* @ 2x10^8 conidia l^{-1} (1: 29.64) (Table 2).

These findings are in close agreement with the findings of Patil (2000) who also reported that *S. litura* could be suppressed by the application of *N. rileyi* with increased yield in groundnut. Similarly, *N. rileyi* was reported to be capable of causing spectacular epizootics in caterpillar pests of cabbage, clover, soybean (Ignoffo, 1981), groundnut, castor, potato, cotton, etc. (Patil et al, 2003, Manjula *et al.*, 2003, 2004). *N. rileyi* appears to be a promising biopesticide in checking the larval population of armyworm as well as in obtaining highest C: B ratio as compared to other management practices.

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