

## Evaluation of Microbials and Botanicals against Defoliators of Soybean

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### ABSTRACT

The present investigation entitled: “evaluation of microbials and botanicals against defoliators of soybean” was conducted during Kharif season of 2016 at Experimental Farm of Department of Entomology, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Treatments revealed that *Beauveria bassiana* and *Nomuraea rileyi* each @ 7.5 g / L and neem seed extract 5 % were most effective in reducing the population of green semilooper and tobacco leaf eating caterpillar as well as registered highest yield of soybean. Dashparni extract 12.5 ml / l was least effective in reducing the semilooper population and higher yield of soybean. Further, this treatment was not effective against *Spodoptera litura*. The neem seed extract 5 % was economically most effective treatment against soybean defoliators followed by *N. rileyi* @7.5 g/l.

**Key word:** Effect of Microbials and Botanical, *Beauveria bassiana* and *Nomuraea rileyi*, Dashparni extract, NSKE @ 5%soybean (*Glycine max* (L.) Merrill).

### INTRODUCTION

Soybean [*Glycine max* (L.) Merrill], a legume is one of the important oilseed crops of Maharashtra and considered as a wonder crop due to its dual qualities viz., high protein content (40-43%) and oil content (20%) besides minerals and vitamins. Soybean is widely cultivated in tropical, subtropical and warm temperate regions. Optimum temperature range for most of the soybean varieties is 26.5 C to 30° C<sup>6</sup>. Soybean is cultivated on 320.15 million ha in the world and India ranks 5th in soybean cultivated area

and production. In India, it is grown over an acreage of 116.285 lakh ha with yield 667 kg per ha and 73.797 lakh MT of annual production. Madhya Pradesh is major growing state contributing about 61.65% of total soybean followed by Maharashtra 25%, Rajasthan 7.8%, and other 4.72%. In Maharashtra, contribution 37.739 lakh ha with productivity 725 kg /ha and production of 26.006 lakh MT<sup>2</sup>. In early seventeen, when soybean was introduced to India only about a to an alarming figure 270, besides 1 mite, 2 millipedes, 10 vertebrates and 1 snail<sup>7</sup>.

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The major insect pests associated with soybean crops are green semilooper, (*Chrysodeixisa acuta*) tobacco leaf eating caterpillar, (*Spodoptera litura*), hairy caterpillar (*Spilosoma obliqua*), stem dozen of minor insect pests were recorded, while in 1997 this number has swelled fly, (*Melanagromyza sojane*), girdle beetle, (*Obereopsis brevis*) and pod borer, (*Helicoverpa armigera*) also inflicts severe damage to the crops leading to huge field losses<sup>4</sup>. To overcome the losses caused by insect pests various control measures have been recommended. The management of pests using chemical insecticides leads to mounting up of the cost of cultivation, environmental pollution, development of insecticide-resistant pest strains and menace to natural enemies and other non-target organisms. As well, the continuous use of pesticides has resulted in resurgence of pesticide-resistant insect populations and elevation of secondary pests to a status of primary importance and biomagnifications of pesticide residues in food and feed<sup>3</sup>. Integrated pest management (IPM) is perceived as the only alternative to combat these problems. Therefore, it is necessary to consider those strategies which are eco-friendly and environmentally safe as well as control the pests efficiently. In this context, the relevance use of bio-pesticide, and use of judicious and need based use of chemical insecticides are in corporate under this study. Integrated Pest Management is perceived as the only alternative to combat these problems.<sup>8</sup> IPM comprises an ecofriendly pest management tactics like biological, cultural, mechanicals methods etc which prove effective for ecofriendly pest management.

#### MATERIAL AND METHODS

The present investigation entitled “Evaluation of microbials and botanicals against defoliators of soybean” was carried out at Research farm, Department of Agricultural Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during *kharif* 2016 with a

view to evaluate the microbials and botanicals against defoliators. Field experiment was laid out in Randomized Block Design with 9 treatments, 3 replication. The gross plot - 4.5 m x 3.0 m and net area was 3.6 m x 2.6 m. Distance between two replications was 1.35 m and between two treatment plots was 0.90 m. Sowing is done 29<sup>th</sup> June, 2016 by dibbling method at the depth of about 3 - 4 cm at a distance of 5 cm Total four sprays as per treatments were undertaken at 15 days interval starting from 15 days after emergence of the crop. Observations on defoliators (semilooper *Chrysodeixis acuta*, tobacco leaf eating caterpillar *Spodoptera litura*, and hairy caterpillar *Spilosima obliqua* if any) and natural enemies, lady bird beetle, chrysopa, and spider was recorded 24 hours before and after 3,7,10, and 14 days after each sprays. The Observations on the larval population of defoliators was recorded from each one meter row length (mrl) by randomly selecting five spots of one meter row length in each plot and average number of larvae /mrl was worked out.

#### RESULTS AND DISCUSSION:-

**Efficacy of microbials and botanicals against defoliators of soybean Semilooper larvae, *Chrysodeixis acuta* (Walker).**

**Mean of 3<sup>rd</sup>, 7<sup>th</sup>, 10<sup>th</sup>, 14<sup>th</sup> days at first spray**

All the microbials and botanicals treatments were significantly superior over control (2.62 larvae / mrl) in reducing larval population of green semilooper, after first spray. Among them, *B. bassiana* @ 7.5 g/l (T<sub>4</sub>) recorded lowest population (1.02 larvae / mrl) and was significantly superior over rest of treatments. Second effective treatment was neem seed extract @ 5 % (T<sub>8</sub>) (1.28 larvae / mrl) being at par with *N. rileyi* @ 7.5 g/l (T<sub>6</sub>). Third effective treatments was *M. anisopliae* @ 7.5 g/l (T<sub>5</sub>) (1.62 larvae/ mrl) and at par *N. rileyi* @ 5 g/l (T<sub>3</sub>), dashparni extract 12.5 ml / l (T<sub>7</sub>), *B. bassiana* @ 5 g/l (T<sub>1</sub>), *M. anisopliae* @ 5 g/l (T<sub>2</sub>).

**Table 1: Effect of microbials and botanicals on the population of soybean semilooper (1<sup>st</sup> spray)**

Sr. No.	Treatment	Concentration	Dose (g / l)	Average population of semilooper / mrl					Mean
				1DBS	3DAS	7DAS	10DAS	14DAS	
1	<i>Beauveria bassiana</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5	0.60 (0.77)	1.13 (1.06)	1.20 (1.09)	1.87 (1.36)	2.60 (1.61)	1.77 (1.33)
2	<i>Metarhizium anisopliae</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5	0.53 (0.73)	1.20 (1.09)	1.33 (1.14)	1.93 (1.39)	2.67 (1.63)	1.88 (1.37)
3	<i>Nomuraea rileyi</i>	(1x10 <sup>8</sup> CFU ml <sup>-1</sup> )	5	0.60 (0.77)	1.07 (1.03)	1.27 (1.12)	2.00 (1.41)	2.53 (1.59)	1.70 (1.30)
4	<i>Beauveria bassiana</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5	0.47 (0.68)	0.80 (0.83)	0.73 (0.85)	1.07 (1.00)	1.53 (1.23)	1.02 (1.01)
5	<i>Metarhizium anisopliae</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5	0.47 (0.68)	1.00 (0.99)	1.13 (1.04)	1.93 (1.39)	2.47 (1.57)	1.62 (1.27)
6	<i>Nomuraea rileyi</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5	0.60 (0.77)	1.07 (1.03)	0.80 (0.89)	1.60 (1.26)	2.07 (1.44)	1.37 (1.17)
7	Dashparni extract	15 % AE	12.5 ml	0.60 (0.77)	1.27 (1.12)	1.20 (1.07)	2.07 (1.43)	2.60 (1.61)	1.77 (1.33)
8	Neem seed extract	5 % AE	5 ml	0.53 (0.73)	0.86 (0.89)	0.87 (0.92)	1.27 (1.11)	2.27 (1.50)	1.28 (1.13)
9	Untreated control	-	-	0.85 (0.57)	2.20 (1.48)	2.53 (1.59)	2.93 (1.71)	3.00 (1.73)	2.62 (1.62)
	F test			NS	Sig	Sig	Sig	Sig	Sig
	SE (m±)			0.06	0.10	0.10	0.09	0.06	0.04
	C.D. at 5%			-	0.29	0.29	0.27	0.17	0.11
	CV %			13.60	15.49	15.76	11.21	6.35	5.03

Figures in parenthesis are square root transformed values. □DBS – Day before spray. □DAS – Day after spray. □□mrl - meter row length

### Mean of 3<sup>rd</sup>, 7<sup>th</sup>, 10<sup>th</sup>, and 14<sup>th</sup> days of second spray

All the microbials and botanicals treatments except dashparni extract 12.5 ml / l (T<sub>7</sub>) were significantly superior over control (2.77 larvae / mrl) in reducing larval population of green semilooper after second spray. Among them, *B. bassiana* @ 7.5 g/ (T<sub>4</sub>) recorded minimum population (1.00 larvae / mrl) was significantly

superior over rest of the treatments. Second effective treatment was neem seed extract @ 5 % (T<sub>8</sub>) (1.28 larvae / mrl) being at par with *N. rileyi* @ 7.5 g/l (T<sub>6</sub>). Third effective treatment was *M. anisopliae* @ 7.5 g/l (T<sub>5</sub>) (1.85 larvae/ mrl) and at par with *N. rileyi* @ 5 g/ (T<sub>3</sub>), *B. bassiana* @ 5 g/l (T<sub>1</sub>). *M. anisopliae* @ 5 g/l (T<sub>2</sub>) was least effective in reducing the larval population of semilooper.

**Table 2: Effect of microbials and botanicals on the population of soybean semilooper (2<sup>nd</sup> spray)**

Sr. No.	Treatment	Concentration	Dose (g / l)	Average population of semilooper / mrl				Mean
				3DAS	7DAS	10DAS	14DAS	
1	<i>Beauveria bassiana</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5 g	1.87 (1.37)	1.93 (1.39)	2.07 (1.44)	2.47 (1.57)	2.07 (1.44)
2	<i>Metarhizium anisopliae</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5 g	1.93 (1.39)	2.00 (1.41)	2.20 (1.48)	2.67 (1.63)	2.20 (1.48)
3	<i>Nomuraea rileyi</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5 g	1.80 (1.33)	1.87 (1.36)	2.13 (1.46)	2.33 (1.53)	2.03 (1.43)
4	<i>Beauveria bassiana</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5 g	0.53 (0.72)	0.80 (0.89)	1.20 (1.09)	1.47 (1.18)	1.00 (1.00)
5	<i>Metarhizium anisopliae</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5 g	1.60 (1.24)	1.80 (1.34)	2.00 (1.41)	2.00 (1.41)	1.85 (1.36)
6	<i>Nomuraea rileyi</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5 g	0.80 (0.89)	1.47 (1.18)	1.87 (1.37)	1.80 (1.31)	1.48 (1.21)
7	Dashparni extract	15 % AE	12.5 ml	2.13 (1.46)	2.40 (1.55)	2.33 (1.52)	2.60 (1.61)	2.37 (1.54)
8	Neem seed extract	5 % AE	5 ml	1.00 (1.00)	1.73 (1.32)	1.80 (1.34)	0.60 (0.77)	1.28 (1.13)
9	Untreated control	-	-	2.73 (1.65)	2.60 (1.61)	3.00 (1.37)	2.73 (1.65)	2.77 (1.66)
	F test			Sig	Sig	Sig	Sig	Sig
	SE (m±)			0.08	0.08	0.05	0.10	0.04
	CD at 5%			0.24	0.23	0.16	0.30	0.12
	CV %			11.32	9.80	6.51	12.49	5.31

Figures in parenthesis are square root transformed values. □DBS – Day before spray. □DAS – Day after spray. □□mrl - meter row length

### Mean of 3<sup>rd</sup>, 7<sup>th</sup>, 10<sup>th</sup> and 14<sup>th</sup> days of third spray

All the microbials and botanicals treatments were significantly superior over control (2.27 larvae / mrl) in reducing larval population of green semilooper after third spray. *B. bassiana* @ 7.5 g/l (T<sub>4</sub>) recorded minimum population (0.78 larvae / mrl) and superior over rest of the treatments. Second effective treatment was *N.*

*rileyi* @7.5 g/l (T<sub>6</sub>) (0.93 larvae / mrl). Stood second followed by neem seed extract @ 5 % (T<sub>8</sub>) (1.27 larvae / mrl) and being at par with *N. rileyi* @ 5 g/l (T<sub>3</sub>), *M. anisopliae* @ 7.5 g/l (T<sub>5</sub>), *B. bassiana* @ 5 g/l (T<sub>1</sub>). dashparni extract 12.5 ml / l (T<sub>7</sub>) was least effective against semilooper and being on par with *M. anisopliae* @ 5 g/l (T<sub>2</sub>).

**Table 3: Effect of microbials and botanicals on the population of soybean semilooper (3<sup>rd</sup> spray)**

Sr. No.	Treatment	Concentration	Dose (g / l)	Average population of semilooper / mrl				Mean
				3DAS	7DAS	10DAS	14DAS	
1	<i>Beauveria bassiana</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5 g	1.00 (1.00)	1.33 (1.15)	1.47 (1.20)	1.73 (1.31)	1.38 (1.17)
2	<i>Metarhizium anisopliae</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5 g	1.33 (1.15)	1.27 (1.12)	1.60 (1.26)	2.00 (1.41)	1.55 (1.24)
3	<i>Nomuraea rileyi</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5 g	1.07 (1.03)	0.93 (0.96)	1.27 (1.12)	1.87 (1.37)	1.28 (1.13)
4	<i>Beauveria bassiana</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5 g	0.53 (0.77)	0.73 (0.85)	0.80 (0.89)	0.93 (0.96)	0.78 (0.88)
5	<i>Metarhizium anisopliae</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5 g	1.07 (1.03)	1.20 (1.09)	1.13 (1.06)	1.80 (1.34)	1.30 (1.14)
6	<i>Nomuraea rileyi</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5 g	0.67 (0.81)	0.80 (0.89)	0.87 (0.92)	1.40 (1.18)	0.93 (0.96)
7	Dashparni extract	15 % AE	12.5 ml	1.13 (1.06)	1.40 (1.17)	1.47 (1.20)	2.13 (1.46)	1.53 (1.24)
8	Neem seed extract	5 % AE	5 ml	1.00 (1.31)	1.27 (1.12)	1.20 (1.09)	1.60 (1.25)	1.27 (1.12)
9	Untreated control	-	-	1.73 (1.31)	2.40 (1.55)	2.20 (1.48)	2.73 (1.65)	2.27 (1.50)
	F test			Sig	Sig	Sig	Sig	Sig
	SE (m±)			0.07	0.06	0.06	0.07	0.03
	CD at 5%			0.21	0.18	0.17	0.21	0.08
	C.V. %			11.98	9.40	8.43	9.17	4.15

### Mean of 3<sup>rd</sup>, 7<sup>th</sup>, 10<sup>th</sup> and 14<sup>th</sup> of fourth spray:

All the microbials and botanicals treatments were significantly superior over control (1.60 larvae / mrl) in reducing larval population of green semilooper, after fourth spray. Among them, *B. bassiana* @ 7.5 g/l (T<sub>4</sub>) (0.43 larvae / mrl) was most effective and at par with neem seed extract @ 5 % (T<sub>8</sub>). Second effective

treatment was *N. rileyi* @7.5 g/l (T<sub>6</sub>) (0.68 larvae / mrl) and being at par with *M. anisopliae* @ 7.5 g/l (T<sub>5</sub>), *N. rileyi* @ 5 g/l (T<sub>3</sub>). dashparni extract 12.5 ml / l (T<sub>7</sub>) was least effective against semilooper and being on par with *M. anisopliae* @ 5 g/l (T<sub>2</sub>) and *B. bassiana* @ 5 g/l (T<sub>1</sub>).

**Table 4: Effect of microbials and botanicals on the population of soybean semilooper (4<sup>th</sup> spray)**

Sr. No.	Treatment	Concentration	Dose(g / l)	Average population of semilooper / mrl				Mean
				3DAS	7DAS	10DAS	14DAS	
1	<i>Beauveria bassiana</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5 g	1.13 (1.05)	1.40 (1.18)	1.00 (1.00)	0.40(0.94)	0.98 (0.99)
2	<i>Metarhizium anisopliae</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5 g	1.27 (1.12)	1.33 (1.15)	1.13(1.06)	0.60(1.05)	1.08 (1.04)
3	<i>Nomuraea rileyi</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5 g l	0.93 (0.96)	1.27 (1.12)	0.93(0.95)	0.27(0.87)	0.85 (0.92)
4	<i>Beauveria bassiana</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5 g	0.47 (0.68)	0.67 (0.81)	(0.47 (0.68)	0.13(0.79)	0.43 (0.66)
5	<i>Metarhizium anisopliae</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5 g	0.67 (0.81)	1.20 (1.09)	0.87(0.93)	0.33(0.91)	0.77 (0.88)
6	<i>Nomuraea rileyi</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5 g	0.73 (0.85)	1.13 (1.06)	(0.67 (0.81)	0.20(0.84)	0.68 (0.83)
7	Dashparni extract	15 % AE	12.5 ml	1.20 (1.09)	1.53 ((1.24)	1.20 (1.09)	0.47(0.98)	1.10 (1.05)
8	Neem seed extract	5 % AE	/ 5 ml	1.00 (1.00)	0.67 (0.81)	0.33 (0.57)	0.33 (0.91)	0.58 (0.76)
9	Untreated control	-	-	1.80 (1.34)	2.00 (1.41)	1.73 (1.31)	1.40 (1.18)	1.60 (1.26)
	F test			Sig	Sig	Sig	Sig	Sig
	SE (m±)			0.07	0.07	0.07	0.04	0.04
	CD at 5%			0.19	0.22	0.22	0.12	0.11
	CV %			11.36	11.47	13.71	7.10	7.17

All the microbials and botanicals treatments were significantly effective over untreated control (2.31 larvae / mrl) in reducing larval population of green semilooper. Treatment with *B. bassiana* @ 7.5 g/l (T<sub>4</sub>) (0.80 larvae / mrl) was most effective and at par with *N. rileyi* @ 7.5 g/l (T<sub>6</sub>) and neem seed extract @ 5 % (T<sub>8</sub>). Dashparni extract 12.5 ml / l (T<sub>7</sub>) was proved least effective against semilooper and it was at par with *M. anisopliae* @ 5 g/l (T<sub>2</sub>), *B.*

*bassiana* @ 5 g/l (T<sub>1</sub>), *N. rileyi* @ 5 g/l (T<sub>3</sub>), *M. anisopliae* @ 7.5 g/l (T<sub>5</sub>). These results are in line with who found *Beauveria bassiana* (5.06 larvae/mrl) and *Metarhizium anisopliae* (6.06 11 larvae/mrl) effective against *Chrysodeixis acuta*. Similarly Anjali Patel also reported the efficacy of *B. bassiana* @ 10<sup>13</sup> spores/ha against semilooper. Whereas Pande, et al.<sup>5</sup> reported the efficacy of NSKE 5% against *C. acuta* and *S. oblique* population.

**Table 5: Cumulative effect of various treatments on population of soybean semilooper of 1<sup>st</sup>, 2<sup>ed</sup>, 3<sup>rd</sup> and 4<sup>th</sup> spray**

Sr. No.	Treatment	Concentration	Dose (g / l)	Average population of semilooper / mrl				Mean
				3DAS	7DAS	10DAS	14DAS	
1	<i>Beauveria bassiana</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5	1.27 (1.11)	1.47 (1.20)	1.58 (1.24)	1.80 (1.36)	1.55 (1.24)
2	<i>Metarhizium anisopliae</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5	1.42 (1.18)	1.48 (1.21)	1.83 (1.34)	1.98 (1.43)	1.65 (1.28)
3	<i>Nomuraea rileyi</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	5	1.20 (1.08)	1.33 (1.14)	1.58 (1.24)	1.75 (1.34)	1.47 (1.20)
4	<i>Beauveria bassiana</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5	0.57 (0.73)	0.73 (0.85)	0.88 (0.92)	1.02 (1.04)	0.80 (0.88)
5	<i>Metarhizium anisopliae</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5	1.07 (1.01)	1.33 (1.14)	1.48 (1.20)	1.65 (1.31)	1.38 (1.16)
6	<i>Nomuraea rileyi</i>	(1x 10 <sup>8</sup> CFU ml <sup>-1</sup> )	7.5	0.80 (0.89)	1.05 (1.00)	1.25 (1.09)	1.37 (1.19)	1.10 (1.03)
7	Dashparni extract	15 % AE	12.5 ml	1.42 (1.18)	1.63 (1.26)	1.77 (1.31)	1.95 (1.42)	1.69 (1.29)
8	Neem seed extract	5 % AE	5 ml	0.93 (0.96)	1.13 (1.04)	1.15 (1.03)	1.20 (1.11)	1.12 (1.04)
9	Untreated control	-	-	2.10 (1.44)	2.38 (1.54)	2.45 (1.55)	2.33 (1.55)	2.31 (1.52)
	F test			Sig	Sig	Sig	Sig	Sig
	SE (m±)			0.07	0.08	0.07	0.07	0.07
	CD at 5%			0.22	0.23	0.20	0.20	0.21
	C.V. %			11.76	11.61	9.97	8.78	10.53

Figures in parenthesis are square root transformed values. □DAS – Day after spray. □mrl - meter row length.

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