

SURVEY ON OCCURRENCE OF *BEAUVERIA BASSIANA* AND ITS EFFICACY ON DIAMOND BACK MOTH (DBM)

SHWETA AGRAWAL*, SOBITA SIMON AND ANOORAG R. TAYDE

Department of Plant Pathology and Entomology,

Sam Higginbottom Institute of Agriculture Technology & Sciences, Allahabad -211 007

e-mail : shweta.agrawal4784@gmail.com

KEYWORDS

Beauveria bassiana
Indarbela quadrinotata
Plutella xylostella

Received on :

11.05.2016

Accepted on :

11.04.2017

*Corresponding author

ABSTRACT

A survey was carried out on natural occurrence of fungal pathogen *Beauveria bassiana* from the Bark eating caterpillar *Indarbela quadrinotata* at ten Guava Orchards i.e. SHIATS, Mahewa, Jhalwa, Preetam Nagar, Khusru baag, Meza, George town, Jhonson ganj, Allahpur and Kaushambi, during September to October 2013-2014. The maximum isolates of *Beauveria bassiana* (10) was collected from Khusrubaa. Ten *B. bassiana* isolates namely- iBb1, iBb2..... iBb10 were evaluated on 3rd larval instar of *Plutella xylostella* (commonly known as DBM- diamond back moth) in the laboratory of Entomology Department, SHIATS, Allahabad. Results revealed that iBb5 was the most virulent as compared with other nine isolates. The maximum mortality percentage of DBM was 34.44 in the isolate of iBb5 which was significantly different from the other isolate followed by iBb6 (29.44) and iBb8 (27.73) including over control. The percent mortality of remaining isolates was as follows : iBb6 29.44 > iBb8 27.77 > iBb9 25.55 > iBb7 24.99 > iBb4 23.88 > iBb10 22.77 > iBb1 21.66 > iBb2 19.44 > iBb3 18.88 > iBb0 2.77. Bb6.

INTRODUCTION

Beauveria bassiana (Balsomo) vuillemin is a naturally occurring entomopathogenic fungus with a very wide host range. *B. bassiana* is the causative agent of the white muscardine disease of many insect species and under certain climatic conditions causes epizootics among field insects and soil borne pests (Tanada and Kaya, 1993). This fungus represents the first example describing a micro-organism as the agent of a contagious disease. Additionally, it has one of the largest host list among the imperfect fungi. It has been isolated from a variety of mites and soil insects e.g., grubs, lepidopteran pupae, termites, ants etc. (Keller and Zimmermann, 1989) and has been successfully used against the Masson's pine caterpillar, *Dendrolimus punctatus*, the European corn borer, *Ostrinia nubilalis*, the Asian corn borer, *Ostrinia furcinalis* and several other pests (Batta, 2007; De Faria and Wraight, 2007).

Guava bark caterpillar (*Indarbela quadrinotata*) is a serious pest of a large number of plant types throughout Asia (Beeson, 1941). Caterpillars are 50-60 mm and have pale brown bodies with dark brown heads. They eat the bark and found inside the tree, feeding for 9-11 months (Nair and Mathew, 1988). The caterpillar eat the underlying layer of the bark and then excreta forms baggy tunnels externally visible *Beauveria bassiana* has been reported to cause mortality of this insect in the field Meeena et al., 2013 found a significant results to microbial agents (*Verticillium lecanii*, *Beauveria bassiana* and *Metarhizium anisopliae*) were evaluated against mustard aphid, *Lipaphis erysimi* (Kalt.) and their safety to natural enemies and pollinators.

The diamondback moth *Plutella xylostella* (DBM) is important

and cosmopolitan pest. In another pest of cruciferous crops in many parts of the world. DBM has been controlled by the various chemical pesticides. In recent years resistance to most of the conventional insecticides has developed (Sun et al., 1986). *Bacillus thuringiensis* is used also to control this pest but there are reports that DBM has developed resistance against the bacteria (Tabashink et al., 1990). The rapid development of resistance is probably associated with the very rapid reproduction of DBM i.e. more than 25 generations per year in the tropics (Keinmeesuke et al., 1985). The problems of insecticides resistance as well as the environmental and consumer health hazards associated with insecticides residues in plant material have focused alternative methods for the control of DBM. Hence, the objective of this study was search effective isolates of *Beauveria bassiana* as biocontrol agents for incorporation in to IPM programmes against diamondback moth *Plutella xylostella*

MATERIALS AND METHODS

Investigations were carried out on natural occurrence of fungal pathogen *Beauveria bassiana* on the bark eating caterpillar *Indarbela quadrinotata* in various guava orchards, and these susceptibility of 3rd larval instar of *Plutella xylostella*, during 2013-2014, at the Department of Entomology, SHIATS, Allahabad.

Survey

A survey was carried out in guava orchards to SHIATS, Mahewa, Jhalwa, Preetam Nagar, Khusru baag, Meza, George town, Jhonston ganj Allahapur in Allahabad district and Kaushambi during September to October, 2013-14. When I.

quadrinata

infestations were occurred at a peak. At each orchard, nine trees were selected along a randomly located transect. On each tree, three frass samples from galleries were collected. Infected cadaver with *B. bassiana* were stored individually at 48 °C in plastic bags in an icebox until they were processed in the laboratory. Before each sampling procedure, all sampling tools were sterilized with 70% ethanol. These sampling tools included a flat pinch bar and a smooth forceps. Samplings were carried out by the method of Reay *et al.* (2008).

Isolation of *Beauveria bassiana*

Whole infected larvae that already showed hyphal growth on their bodies were placed on Sabouraud dextrose agar (SDAY) containing 0.01% chloramphenicol to prevent bacterial contamination conditions. The larvae were incubated at 23 ± 2 °C until adequate growth of fungus is observed, then the fungus was transferred to fresh SDAY medium and incubated for at least 7 days under the same conditions. Pure culture were obtained through the series (2-3) of subcultures of the original inoculation on SDA.

Identification of fungi

Mycotaxonomic keys of Samson *et al.* (1988) were used for the identification of the fungus. *B. bassiana* was identified by their mycelial growth, spores characters and pigmentation of culture medium. Sample stains with lectophenol and aniline blue for mounting between the slides and fungi was observed

Table 1: Ten isolates of *Beauveria bassiana* infected insect host *Indarbela quadrinotata* from different location of Allahabad and kaushambi in UP.

Isolates Code (iBb)	Collected place	Average of Infected cadaver of <i>I. quadrinotata</i> (from nine trees)
iBb 1	SHIATS	8
iBb 2	Mahewa	9
iBb 3	Jhalwa	9
iBb 4	Preetam Nagar	7
iBb 5	Khusro baag	10
iBb 6	Meza	6
iBb 7	George town	7
iBb 8	Jhonson ganj	5
iBb 9	Allahpur	8
iBb 10	Kaushambi	9

Table 2: Efficacy of different isolates of *Beauveria bassiana* on 3rd instar of Diamondback moth

Treatment	3 Days	5 Days	7 Days	Total
iBb 1	11.66	25.00	38.33	21.66
iBb2	15.00	26.66	36.00	19.44
iBb3	11.66	20.00	35.00	18.88
iBb4	13.33	21.66	36.66	23.88
iBb5	18.33	38.33	50.00	34.44
iBb6	13.33	26.66	46.66	29.44
iBb7	13.33	23.33	48.33	24.99
iBb8	10.00	28.33	45.00	27.77
iBb9	8.33	25.00	43.33	25.55
iBb10	6.66	23.00	51.66	22.77
Control	0.00	0.00	8.33	2.776
S. ED(+)	6.85	12.92	16.93	11.39
CD at 0.05%	5.07	8.90	10.04	9.24

under a light microscope.

Colonies of *B. bassiana* were grows as a white mould. Under microscopical observations it was found that conidia in white spore balls. Each spore ball is composed of a cluster of conidiogenous cells. The conidiogenous cells of *B. bassiana* are short and ovoid, and terminate in a narrow apical extension called a rachis. The rachis elongates after each conidium is produced, resulting in a long zig-zag extension. This method was followed by Aneja (2005).

Bioassay

Spore suspension was prepared from 15 days old culture of *B. bassiana* on SDA medium. The fungal surface was scaped using a sterile loop with 10 ml of sterile distilled water having 0.02% Tween 80 as a wetting agent (Rombach *et al.*, 1986). The suspension was then filtered through sterile muslin cloth to eliminate the medium (Sasidharan and Verma, 2005). Spore concentration of the filtrate was determined by serial dilution. This served as the stock suspension. Dose 3% (2.1×10^8 spore) concentration was prepared by adding sterile 0.02 % Tween 80 (Malarvannan, *et al.*, 2010), for 10 isolates from above Allahabad location and tested for its pathogenicity on 3rd instar of DBM.

The pathogenicity tests in laboratory

The pathogenicity tests with different isolates of *B. bassiana* against the larvae of DBM were done in laboratory of Entomology Department. The larvae of DBM were used for pathogenicity tests. The conidial concentration of different *B. bassiana* isolates were standrilized on a young cabbage green leaf in the petriplates, the leaf was dipped with above fungal suspension and after drying put inside to petriplates, each have three replicates. Mortality cause was taken at 3, 5 and 7 days after inoculating. Percent mortality was corrected by a formula as suggested by Abbott (1925).

RESULTS AND DISCUSSION

The data are presented in Table No. shows that a total 78 cadavers collected from various orchards of guava. In which, the maximum number of isolates of *B. bassiana* were collected from Khusro Baag (10) and then Mahewa, Jhalwa and kaushambi around Allahabad and kaushambi. Whereas, minimum no. of isolates (5) were collected from Jhonson ganj. This survey results was supported by Fasih and Srivastava (1988), they studied on the diversity of *B. bassiana* and their

infestation on *I. quadrinotata* in large areas of Lucknow during the months March and July.

The results are presented in Table No. 2, revealed that maximum percent mortality of DBM was recorded in the isolate of iBb5 (34.44) as compared with iBb 6 (29.44), iBb8 (27.73), iBb9 (25.55), iBb7 (24.99), iBb4 (23.88), iBb10 (22.77), iBb1 (21.66), iBb2 (19.44) and iBb3 (18.88) including with control (2.77). However, the isolates iBb5, iBb6 and iBb8 were found non-significant effect to each other but they are significant from rest of the isolates. Whereas, least mortality percent was recorded in the isolates of iBb3 excluding control iBb0. Similar as Vanlaldikli *et al.* (2013) *Beauveria bassiana* also provided significant effect in suppressing the larval population as compared to untreated control.

Our results, the isolate of iBb5 was found maximum percent mortality of DBM (34.44), which are supported by Arshad and Hafiz (1983) recorded 33.8-45% larval mortality in the field and 21.4-33.6% mortality in lab trials. Ferron (1981) also reported the entomopathogenic fungi *B. bassiana* plays an important role in the regulation of pest population. Dhembare and Siddique (2004) reported that *B. bassiana* was evaluated against gram pod borer *H. armigera* in the laboratory condition and found that after the treatment of the fungus on the 1st, 3rd, and 5th days revealed that as the spore intensities increased, the larval mortality also increased.

ACKNOWLEDGEMENT

I would like to express my deepest gratitude towards the Department of Plant Pathology & Entomology, SHIATS, Allahabad for enabled me to work in suitable and supportive environment.

REFERENCES

- Abbott, W. S. 1925. A method of competing the *Phthorimaea operculella* (Zeller). Ph.D. thesis.
- Aneja, K. R. 2005. Identification of an unknown microorganism. In: Experiments in Microbiology, Plant Pathology and Biotechnology. New Age international publishers, New Delhi, India. pp.76-294
- Arshad, M. and Hafiz, I. A. 1983. (Bals.) Vuill., on *Indarbela quadrinotata* Wlk., Pseudarbelidae: Lepidoptera. *Bulletin of Zoology*. **1(1)**: 1-16.
- Batta, Y. A. 2007. Biocontrol of almond bark beetle (*Scolytus amygdale* Geurin-Meneville, Coleoptera: Scolytidae) using *Beauveria bassiana* (Bals.) Vuill. (Deuteromycotina: Hyphomycetes). *J. Appl. Microbiol.* **103**:1406-1414.
- Beeson, C. F. C. 1941. The ecology and control of forest insects of India and the neighbouring countries. *Govt. of India*, p.767.
- De Faria, M. and Wraight, S. P. 2007. Perspective mycoinsecticides a mycoacaricides: A comprehensive list with worldwide coverage and international classification of formulation types. *Biological Control*. **43**: 237-256.
- Dhembare, A. J. and Siddique, N. H. 2004. Evaluation of mycoinsecticide, *Beauveria bassiana* (Balsamo) formulation against gram pod borer, *Helicoverpa armigera*. *J. Experimental Zoology*. **7**: 319-324
- Fasih, M. and Srivastava, R. P. 1988. Natural occurrence of *Beauveria bassiana* an entomogenous fungus on bark eating caterpillar, *Indarbela* spp. *Indian J. Plant Pathology*. **6(1)**: 11-16.
- Ferron, P. 1981. Pest control by the fungi *Beauveria* and *Metarhizium*. In: Microbiol Control of pest plant diseases, H.D Burges (Eds). Academic press, London, pp. 465-482.
- Keinmeesuke, P., Vattanatangum, P., Sarnthoy, O., Sayampol, B., Saito, T., Nakasnji, F. and Sinchaisria, N. 1985. Life table of diamondback moth and its egg parasite *Trichogrammatoidea bactrae* in Thailand. In : Talekar, N.S. (Ed.), diamondback moth and other crucifer pests: proceedings of the second international workshop, Asian Vegetable Research and Development Center. AVRDC, Tainan, Taiwan, pp.309-315.
- Keller, S. and Zimmermann, G. 1989. Mycopathogens of soil insects. In: Insect-fungus Interactions. (Wilding, N., Collins, N.M., Hammond, P. M. and Webber, J. F., Eds.), pp. 239-270.
- Malarvannan, S., Murali, P. D., Shanthakumar, S. P., Prabavathy, V. R. and Sudha Nair, 2010. Laboratory evaluation of the entomopathogenic fungi, *Beauveria bassiana* against the Tobacco caterpillar, *Spodoptera litura* Fabricius (Noctuidae: Lepidoptera). *J. Biopesticides*. **3(1)**: 126-131.
- Meena, H., Singh, S. P. and Nagar, R. 2013. Evaluatio of Microbial agents and Bio-products for The Management of mustard aphid, *Lipaphis erysimi* (kalt.). *The Bioscan*. **8(3)**: 747-750.
- Nair, K. S. S. and Mathew, G. 1988. Biology and control of insect pests of fast growing hardwood species. *KFRI*, p. 51.
- Reay, S. D., Brownbridge, B., Cummings, N. J., Nelson, T. L., Souffre, B., Lignon, C. and Glare, T. R. (2008). Isolation and characterization of *Beauveria* spp. associated with exotic bark beetles in New Zealand *Pinus radiata* plantation forests. *Biological Control*. **46**: 484-494.
- Rombach, M. C., Aguda, R. M., Shepard, B. M. and Roberts, D. W. 1986. Infection of rice brown plant hopper, *Nilaparvata lugens* (Homoptera: Delphacidae) by field application of entomopathogenic Hyphomycetes (Deuteromycotina). *Environmental Entomology*. **15**: 1070-1073.
- Samson, R. A., Evans, H. C. and Latge, J. P. 1988. Atlas of fntomopathogenic Fungi. Springer-Verlag, Berlin, p. 187.
- Sasidharan, K. R. and Varma, R. V. 2005. Laboratory evaluation of *Beauveria bassiana* (Balsamo) Vuillemin against *Indarbela quadrinata* Walker (Lepidopteron: Metarbelidae) a key pest of *Casuarina equisetifolia* Lin. Tamil Nadu. *J. Biological Control*. **19**: 197-200.
- Sun, C. N., Wu, T. K., Chen, J. S. and Lee, W. T. 1986. Insecticide Resistance in Diamondback Moth. In: Talekar,N.S., Griggs, T.D. (Eds.), Diamondback Moth Management: Proceedings of the First International Workshop, Asian Vegetable Research and Development Center. AVRDC, Shanhuu, Taiwan, pp. 359-371.
- Tabashink, B. E., Cushing, N. L., Finson, N. and Johnson, M. W. 1990. Field development of resistance to *Bacillus thuringiensis* in Diamondback moth (Lepidoptera: Plutellidae). *J. Economic Entomology*. **83**: 1671-1676.
- Tanada, Y. and Kaya, H. K. 1993. Insect Pathology. Academic. Press. Inc. New York, USA, p. 66
- Vanlaldiki, H., Premjit Singh, M. and Sarkar, P. K. 2013. Efficacy of eco-friendly insecticides on the Management of diamondback moth (*plutella Xylostella* linn.) On cabbage. *The Bioscan*. **8(4)**:1225-1230

NATIONAL ENVIRONMENTALISTS ASSOCIATION

AND ITS OFFICIAL ORGAN



The Bioscan

An International Quarterly Journal of Life Science

Started in 1988, the National Environmentalists Association has been reorganized in 2006 and now is an association functioning with full vigour and new impetus to meet its objectives with the co-operation of like minded environment conscious academicians from different parts of the nation.

MEMBERSHIP OF THE ASSOCIATION

Any graduate having interest in environmental conservation and protection of nature and natural resources can be the member of the association.

To be the member of the association the application form given below should be duly filled up and sent to the Secretary of the association along with a demand draft of Rs. 750/- (After the 25% concession) for annual membership and Rs. 7500/- (After the 25% concession) for life membership.

FELLOWSHIP OF THE ASSOCIATION

The Association is awarding FELLOWSHIP to deserving academicians / researchers /scientists who are LIFE MEMBERS of the Association after reviewing their bio-data by the Fellows and the Executive Members of the association. The Fellows are privileged to write **F.N.E.A.** after their names .The prestigious Fellowship also includes a citation in recognition of their contribution to society in general and the endeavour for the noble cause of environment in particular.

AWARDS OF THE ASSOCIATION

The Association in its Seminars and Conferences provides the following category of awards on annual basis.

1. **The young scientists award** : It is given to the researchers below the age of 35 years.
2. **The senior scientists award** : It is awarded to the academicians above the age of 35 years.

3. **The best paper award**: It is awarded to the contributor of the Journal **The Bioscan** during the year.
4. **The best paper presentation award** : It is awarded to the scholar whose presentation is the best other than the young scientist category.
5. **The best oration award** : It is awarded to the scholar who delivered invited speech.
6. **The recognition award** : It is awarded to those senior scholars who have contributed to the subject through their continued research .
7. **The environmental awareness award** : It is awarded to those who, apart from their research contribution, have done commendable extension work for environmental betterment.

The number of recipients of award in each category will vary depending upon the recommendation of the panel of judges and the executive committee. The association has the provision to institute awards in the name of persons for whom a with desired sum is donated in consultation with the executive body.

PUBLICATION OF THE ASSOCIATION

In order to provide a platform to a vast group of researchers to express their views and finding of research as well as to promote the attitude of quality research among the scholars of younger generation the association publishes an international quarterly journal – **THE BIOSCAN (ISSN:0973-7049)**. For the benefit of the potential contributors **instructions to authors** is given separately in this journal. However, the details regarding the journal and also the association can be seen on our website www.thebioscan.in.

Cont. P. 748