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Research Article

Determination of an Effective Dose of *Beauveria bassiana* (Balsamo) Vuillemin against Garlic *Thrips tabaci* Lindeman

KN Savariya*

Department of Entomology, Junagadh Agricultural University, Junagadh, Gujarat, India

ABSTRACT

B. bassiana has effect over garlic thrips and they can be used as pesticides. The *B. bassiana* are grown in sterile conditions. The dosages of *B. bassiana* are prepared in different concentrations to known the maximum effect towards garlic thrips. In this experiment, all doses of *B. bassiana* are productive but *B. bassiana* 1.15% WP@6 g/litre of water proved to be the most effective dose among five doses tested against *T. tabaci*, which was followed by *B. bassiana* 1.15% WP@5 g/litre. Treated leaves were allowed to dry under ceiling fan for 5 minutes. The one day old 3rd instar nymphs of *T. tabaci* were kept in petri dishes.

Keywords: Bio-efficacy; *B. Bassiana*; Compatibility; Garlic; *T. Tabaci*

INTRODUCTION

Garlic (*Allium sativum L.*) belongs to Alliaceae family [1]. The origin of garlic is thought to be in Central Asia (India, Afghanistan, West China, Russia) and spread to other parts of the world through trade and colonization [2]. Garlic is the most important *Allium* crop and ranks second next to onion in the world [3]. It comprises more than 600 species [4]. The oil of garlic is volatile and has sulphur combining compounds which is responsible for strong odour, its unique flavor and pungency as well as for healthful benefits [5]. Garlic is a basic flavouring in many types of dishes [6].

Garlic has also medicinal value which is well recognized in the control and treatment of hypertension, worms, germs, bacterial and fungal diseases, diabetes, cancer, ulcer, rheumatism etc. [7,8]. Garlic can be used as a disinfectant because of its bacteriostatic and bactericidal properties [9]. It is a rich source of protein, phosphorus, calcium, magnesium, potash and ascorbic acid. In one fresh peeled garlic cloves having 62.8% moisture, 6.3% protein, 0.1% fat, 0.8% fiber, 29.0% carbohydrates, 0.03% calcium, 0.31% phosphorus etc. [10].

In the world, the production of garlic ranks 1st in China 200 lakh tons followed by India 11.50 lakh tons and Republic of Korea 3.39 lakh tons [11]. In India, garlic is cultivated in about 2.62 lakh hectares with total production of 14.25 lakh tons and a productivity of 5.44 tons/ha [11]. In Gujarat, garlic is commonly known as "Lasan". It is grown in about 0.40 lakh hectares with total production of 3.18 tons and a productivity of 7.84 tons/ha [11]. The important districts in Gujarat where garlic is growing on large scale are Jamnagar, Rajkot, Bhavnagar, Junagadh etc. There are various pests responsible for reducing the crop yield. The thrips, *Thrips tabaci* Lindeman is one of the most common and serious pest of garlic. It belongs to family "*Thripidae*" and order "*Thysanoptera*". It was first recorded in North America in 1872. In India, the pest was recorded for the first time by Karmy in 1926 from the material collected by T. V. R. Ayyar in 1920 from cotton flower at Coimbatore [12]. Ayyar stated that garlic suffered more from thrips than onion [13].

Thrips prefer to feed on newly emerged leaves in the center of neck therefore, majority of thrips are found at the base of the younger leaves in the lower center of the neck on garlic. Both nymphs and adults of the pest rasp the epidermis of garlic leaves and suck the sap that exudes. This leads to an irregular or blotchy whitening of the leaves, a condition sometimes termed "blast". High levels of feeding injury disrupt the hormonal balance of the plant, causing the leaves to curl and twist and the foliage to be stunted [14]. In case of severe infestation, the bulb remains undersized and gets distorted [15].

Mittal and Butani recorded 27.07 to 45.32% damage due to thrips in garlic in Saurashtra region of Gujarat state which ultimately reduced 36.0 to 69.0% yield of crop [16]. Further, Changela observed 15.35 to 46.82% loss in yield due to thrips in garlic [17].

Pesticides are undoubtedly effective for averting pest attacks on garlic, but indiscriminate use of chemical insecticides has created

Correspondence to: K N Savariya, Department of Entomology, Junagadh Agricultural University, Junagadh, Gujarat, India, Tel: 9106919953; E-mail: k2791994@gmail.com

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many adverse effects resulting into environmental problems, health hazards and poor quality due to chemical residues. To overcome these problems, it is necessary to explore eco-friendly management of this pest without having harmful effects and can be well suited in the Integrated Pest Management programme. In this context, an alternative strategy likes use of bio-pesticides particularly B.bassiana has come up into vogue during the last two decades. For more efficacy of B.bassiana, study on determination of an effective dose of *Beauveria bassiana* (Balsamo) Vuillemin against Garlic thrips *Thrips tabaci* Lindeman.

MATERIALS AND METHODS

Maintenance of culture

In order to develop the initial culture of thrips, *T. tabaci*, large number of adults were collected with the help of aspirator from the garlic field cultivated at Agronomy Farm, Junagadh Agricultural University campus, Junagadh. Five females and two males were picked up individually by means of moistened camel hair brush and released gently into a glass tube (3 cm × 1 cm) held in an inverse position. The male and female adult sex differentiation ascertained on the basis of their body color, size and abdominal tip. The males were smaller in size, pale yellow in colour with its two pair of narrow fringed wings, with long hairs, whereas the females were dark brown to black with pointed abdominal tip. The thrips move upward and gathered in upper portion of the inverted tube. A young leaflet of garlic was introduced into a glass tube and it was closed with cotton cork. Thus, field collected adults were distributed in 25 tubes to obtain large number of progenies. The glass tube was kept in an incubator adjusted 25 ± 1°C temperature for oviposition. As soon as the nymph emerged out, they reared separately into the glass tube. The leaflets were changed once every 2 days until the nymph pupated. The rearing was continued till the emergence of adults.

Information of the tested *B. bassiana* formulation

The wettable dispersible powder formulation of *B. bassiana* supplied by Biocontrol Research Laboratory, Junagadh Agricultural University, Junagadh was used for the present study. Its trade name is "SAWAJ BEAUVERIA". Local strain of *B. bassiana* @ 2 × 106 cfu/g was used in all study.

Location: Biocontrol Research Laboratory, Department of Entomology, College of Agriculture, Junagadh

Design: CRD

Replications: 5

Treatments: 5

Treatments:

1. *B. bassiana* 1.15% WP@3 g/ litre of water
2. *B. bassiana* 1.15% WP@4 g/ litre of water
3. *B. bassiana* 1.15% WP@5 g/ litre of water
4. *B. bassiana* 1.15% WP@6 g/ litre of water
5. *B. bassiana* 1.15% WP@7 g/ litre of water

Fresh garlic leaves collected from the unsprayed garlic field, washed properly with clean water and air-dried were used for the study. The spray of each treatment was applied to garlic leaves separately with the help of atomizer. Care was taken to obtain the uniform coverage of treatment. These treated leaves were provided as food for them. Ten nymphs per treatment in each repetition were kept. The nymphs were provided with fresh untreated food after 24 hours of feeding on the treated food.

Observation recorded

Mortality counts were recorded at 1, 3 and 5 days after the treatment. Data on nymphal mortality was converted into corrected per cent mortality as suggested by Henderson and Tilton [18].

Percent mortality= $100 \times \left[1 - \frac{T_a \times C_d}{T_b \times C_a}\right]$

Where,

Ta=Number of thrips counted after treatment

Tb=Number of thrips counted before treatment

Ca=Number of thrips counted from untreated control plot after treatment

Cb=Number of thrips counted from untreated control plot before treatment

The data thus obtained was transformed into Arcsine and analyzed statistically. The zero and cent per cent values were removed by the following formulae [19,20].

For zero per cent= $\left[\frac{1}{4n}\right] \times 100$

For cent per cent= $\left[1 - \frac{1}{4n}\right] \times 100$

Where,

n=Number of nymphs per treatment

RESULTS AND DISCUSSION

In Table 1 shows determination of an effective dose of *B. bassiana* against *T. tabaci*.

One day after treatment

B. bassiana 1.15% WP at all the tested doses gave higher mortality percentage compared to control Table 1. The higher dose of *B. bassiana* 1.15% WP (7.0 g/litre) recorded significantly highest mortality (22.40%) of thrips compared to all other doses whereas, *B. bassiana* 1.15% WP@6.0 g/litre found next at par with 21.60% mortality. The remaining treatments (*B. bassiana* 1.15% WP@5 g/litre and 4 g/litre) of lower doses caused 16.00 and 14.40% mortality, respectively, while *B. bassiana* 1.15% WP@3 g/litre exhibited the lowest (9.60%) mortality of thrips in garlic.

Table 1: Determination of an effective dose of *B. bassiana* against *T. tabaci.*

Sr. No.	Treatments (Dose/lit)	Per cent corrected mortality		
		1 DAT	3 DAT	5 DAT
1	*B. bassiana* 1.15% WP@3 g	*18.05(9.60)	36.39(35.20)	38.29(38.40)
2	*B. bassiana* 1.15% WP@4 g	22.30(14.40)	47.06(53.60)	54.09(65.60)

3	*B. bassiana* 1.15% WP@5 g	23.58(16.00)	49.84(58.40)	58.56(72.80)
4	*B. bassiana* 1.15% WP@6 g	27.69(21.60)	61.21(76.80)	82.73(98.40)
5	*B. bassiana* 1.15% WP@7 g	28.25(22.40)	64.01(80.80)	90.00(100.00)
S.Em. ±		0.91	0.76	1.48
C.D. at 5%		2.69	2.26	4.37
C.V.%		8.53	3.31	5.08

Note: *Data in parentheses are original values, while outside values are arcsine transformed, DAT: Day After Treatment , Local strain of *B. bassiana* @ 2 × 106 cfu/g was used.

Three days after treatment

The mortality data of *T. tabaci* in garlic after 3 days of treatment table indicated that the higher dose (7 g/litre) of *B. bassiana* 1.15% WP recorded significantly the highest mortality (80.80%) of *T. tabaci* and another next better treatments were *B. bassiana* 1.15% WP@6 g/litre and 5 g/litre as it exhibited 76.80% and 58.40% mortality, respectively. The rest of treatments (*B. bassiana* 1.15% WP@4 g/litre and 3 g/litre) with lower doses remained less toxic to *T. tabaci*, as it recorded 53.60 and 35.20% mortality, respectively.

Five days after treatment

Perusal of data presented in table after 5 days of application signposted that *B. bassiana* 1.15% WP@7.0 g/litre exhibited significantly superior in thrips with cent per cent mortality to all other treatments and it was at par with *B. bassiana* 1.15% WP@6.0 g/litre as it unveiled 98.40% mortality. *B. bassiana* 1.15% WP@5 g/litre and 4 g/litre were found next better dose by registering 72.80% and 65.60% thrips mortality, respectively. The lowest mortality (38.40%) was found in *B. bassiana* 1.15% WP@3 g/litre.

Above results disclosed that the total nymphal mortality in all the treatments was increased with increasing doses of *B. bassiana*. The results also indicated that the nymphal mortality was found to be attributed to the doses of *B. bassiana*. The higher dose of 7.0 g/litre caused highest mortality followed by the doses of *B. bassiana* 1.15% WP@6.0 g/litre, 5.0 g/litre, 4.0 g/litre and 3.0 g/litre. It was also noted that the nymphal mortality started from the first day after the treatment and gradually increased at subsequent days. The highest mortality of nymph was recorded at five days after the treatment.

This study concluded that higher doses of *B. bassiana* 1.15% WP was highly effective against *T. tabaci* in garlic, which was confirmed by Abe and Ikegami, who found that *T. tabaci* was highly susceptible to isolate KOG02, even by inoculation of the conidial suspension of *B. bassiana*@1 × 106 conidia/ml [21].

The present results concur to the findings of Gajera et al.,who found that the application of *B. bassiana*@7 g/litre and 8 g/litre recorded 95.33% and 97.71% mortality, respectively and it was decreased with decreasing dose of *B. bassiana* for effective control of *T. tabaci* in garlic under laboratory condition. In this study, *B. bassiana*@7 g/litre and 6g/litre recorded 100.00% and 98.40% mortality of *T. tabaci*, respectively after 5 days of treatment [22,23].

The present study signposted that the higher doses (7.0 and 6.0 g/litre) of *B. bassiana* 1.15% WP prove to be the most effective against *T. tabaci* in garlic. The lower doses of *B. bassiana* 1.15% WP (5.0, 4.0 and 3.0 g/litre) showed comparatively lower effect than higher doses. This statement was confirmed by Patil et al.,[23] who elucidated that *B. bassiana*@7.5 g/litre and 5 g/litre were found effective to control thrips in onion.

CONCLUSION

The *B. bassiana* at each five doses resulted superior in case of thrips over check. The *B. bassiana* 1.15% WP@7.0 g/litre caused the highest mortality of 100.00% and it was at par with *B. bassiana* 1.15% WP@6.0 g/litre (98.40%). It was followed by *B. bassiana* 1.15% WP@5.0 g/litre (72.80%). The remaining lower doses of 4.0 and 3.0 g/litre expressed inferior results. Considering the efficacy along with cost of effective doses, the *B. bassiana* 1.15% WP@6.0. More or less similar tendency of research was also perceived in this study. Thus, this investigation is in close agreement with the results of the earlier worker.

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