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Determination of an effective dose of *Beauveria bassiana* against *Thrips tabaci* infesting onion

Kachot AV, Jethva DM, Kaneria PB and Wadaskar PS

Abstract
Onion (*Allium cepa* L.) is one of the most important vegetable crops, among the various bulbous vegetables. There were many insect pest attack on the onion crop among them management of thrips was quite difficult. Management of thrips is problematic due to their minute size, hidden in crevices of flowers and leaf sheaths, and high reproductive capacity leads quickly to great numbers, infesting individual plants. Due to that the experiment was carried out to determine the effective dose of the *Beauveria bassiana* against *Thrips tabaci* infesting onion. Results revealed that The *B. bassiana* at each five doses resulted superior in case of thrips over check. The *B. bassiana* 1.15% WP @7 g/litre caused the highest mortality of 92.50%and it was at par with *B. bassiana* 1.15% WP @6 g/litre and *B. bassiana* 1.15% WP @5 g/litre, which both caused 90.00% mortality. The remaining lower doses of4 and 3 g/litre expressed inferior results. Considering the efficacy along with cost of effective doses, the *B. bassiana* 1.15% WP @5 g/litre was found the most effective dose against *T. tabaci*.

Keywords: Onion, *Beauveria bassiana*, *Thrips tabaci*

Introduction
Onion (*Allium cepa* L.) is one of the most important vegetable crops, among the various bulbous vegetables. It is member of Amarllidaceae family, which is commercially grown in tropical and subtropical countries. Among the vegetable crops grown in the country, onion assumes significance in the national economy by occupying fifth position. It is grown for consumption as green leaf and mature bulbs. Both mature and immature bulbs of onion are used as vegetable and also as a condiment. According to colour, there are three types of varieties (Red, White and Yellow), among which red and white varieties are extensively grown in India. Onion possesses nutritional and medicinal properties. According to Rao and Purewal (1954) [1], it contains 86.6% moisture, 1.2% protein, 0.1% fat, 11.6% carbohydrates, 0.18% calcium, 0.7% phosphorous and 0.4% mineral matter. It also contains vitamin-B and traces of vitamin-C to the extent of 120mg and 11 mg per 100g fresh weight, respectively. Its pungency is due to volatile compound called "allyl propyl disulphide", which acts as gastric stimulant and promotes digestion. In India, onion is grown on large scale and stands second in productivity next to china. The main growing states of India are Gujarat, Maharashtra, Uttar Pradesh, Rajasthan, Karnataka, Madhya Pradesh, Punjab and Tamil Nadu. In India, onion is being grown in area of 1203 thousand hectares of land with total production of 19402 thousand tons (Anon., 2014) [2]. The major onion growing districts of Gujarat state are Bhavnagar, Junagadh, Jamnagar, Rajkot, Amreli, Surendranagar, Mehsana, Surat, Kheda with an area of about 61.3 thousand hectare and total production of 1562 thousand tons (Anon., 2014) [2]. There were many insect pest attack on the onion crop among them management of thrips was quite difficult. Management of thrips is problematic due to their minute size, hidden in crevices of flowers and leaf sheaths, and high reproductive capacity leads quickly to great numbers, infesting individual plants. In most target crops, use of synthetic pesticides is the most commonly used option for controlling thrips. The concealed habit and reproduction of thrips species make their management very difficult with the use of chemical method to be the most commonly adopted control option. These treatments caused residue and insecticide resistance problems, are costly and undesirable, with regard to risks to operators, livestock and non-target organisms. Certain plant and microbial derived products like *Beauveria bassiana* have been promoted in recent years as alternative to traditional chemical method. Therefore, the studies have been carried out to test identification of the determination of the effective dose at which we can get the maximum efficacy of *Beauveria bassiana* against *Thrips tabaci* infesting onion.

Materials and Methods

Rearing technique

In order to develop the initial culture of thrips, *Thrips tabaci*, and large number of adults were collected with the help of aspirator from the onion field cultivated at instructional 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 (3cm X 1cm) held in an inverted position. The male and female adult sex differentiation ascertained on the basis of their body colour, 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 moved upward and gathered in upper portion of the inverted tube. A young leaflet of onion 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 tubes were kept in an incubator adjusted 25± 1 ºC temperature for oviposition.

As soon as the nymph emerged out, they reared separately into the glass tube. The leaflets were changed every 2 days until the nymph pupated. The rearing was continued till the emergence of adults.

Information of the tested *B. bassiana* formulation

The wet table dispersible powder formulation of *B. bassiana* supplied by Biocontrol Research Laboratory, Junagadh Agricultural University, and Junagadh was used for the present study. Its trade name is "SAWAJ BEAUVERIA". Local strain of *B. bassiana* @2 x 10^6cfu/g was used in all study.

Determination of an effective dose of *B. bassiana*

1. Location	:	Biocontrol Research Laboratory, Department of Entomology, College of Agriculture, Junagadh Agricultural University, Junagadh.
2. Design	:	CRD
3. Replication	:	4
4. Treatment	:	5

Treatment details

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

Methodology

Fresh onion leaves were collected from the unsprayed onion field washed properly with clean water and air-dried was used for the study. The spray of each treatment was applied to onion leaves separately with the help of atomizer. Care was taken to obtain the uniform coverage of treatment. Treated leaves were allowed for drying under ceiling fan for 5 minutes. The one day old 3rd instar nymphs of *T. tabaci* were kept in petri dishes. 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.

Observations

Mortality counts were recorded at 1, 3 and 5 days after the treatment. Data on nymphal mortality were converted into corrected per cent mortality as suggested by Henderson and Tilton (1955) [3].

$$\text{Corrected per cent mortality} = 100\left[1 - \frac{Ta \times Cb}{Tb \times Ca}\right]$$

Where,

Tb = Number of thrips counted before treatment

Ta = Number of thrips counted after treatment

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

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

The data thus obtain were transformed into Arcsine and analyzed statistically. The zero and cent per cent values were removed by the formulae (Bartlett, 1947 and Gomez and Gomez, 1984)

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

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

Where, n = Number of nymphs per treatment

Results and Discussion

Perusal of data presented in Table 1 and 1 day after treatment indicated that the higher dose of *B. bassiana* @7 g/liter proved to be the most effective as it recorded 17.50% mortality, followed by *B. bassiana* @6 g/liter (15.00%). While moderate mortality was observed in *B. bassiana* 1.15% WP @5 g/liter (12.50%). *B. bassiana* 1.15% WP @4 g/liter recorded very low mortality (2.50%) and there was no mortality observed in treatment of *B. bassiana* 1.15% WP @3 g/liter.

Data recorded at 3 days after treatment revealed that the highest (50.00%) mortality was observed in treatment of *B. bassiana* 1.15% WP @7 g/liter, and it was followed by treatment of *B. bassiana* 1.15% WP @6 g/liter(42.50%). The treatment of *B. bassiana* 1.15% WP @5 g/liter (40.00%) was found next in order, whereas *B. bassiana* 1.15% WP @4 g/liter and 3 g/liter were found less effective with lower mortality of 20.00% and 10.00%, respectively.

Perusal of data on nymphal mortality of *T. tabaci* at 5 days after application revealed that the *B. bassiana* 1.15% WP @7 g/liter exhibited significantly superior in nymphal mortality (92.50%), which was at par with *B. bassiana* 1.15% WP @6 and 5 g/liter doses, which registered 90.00% mortality in both treatments. The *B. bassiana* 1.15% WP @4 g/liter and3 g/liter were found less effective as it recorded 40 to 60% mortality of thrips.

At 1 day after treatment, data showed that mortality was found less in every treatment but as the time lapse, mortality percentage was increased significantly and the highest mortality was observed at 5 days after treatment. As the dose of *B. bassiana* increased, the mortality percentage was also significantly increased but no significant difference was observed at 5 days after treatment in *B. bassiana* 1.15% WP @5g/liter, 6g/liter and 7 g/liter.

During the present study, higher doses of *B. bassiana* 1.15% WP was highly effective against *T. tabaci* in onion, which was confirmed by Abe and Ikegami (2005) [4], who found that *T. tabaci* was highly susceptible to isolate KOG02, even by

inoculation of the conidial suspension of *B. bassiana* @1 x 10^6 conidia/ml. In this study, *B. bassiana* 1.15% WP@ 7g/liter and 6 g/liter recorded 92.50 and 90.00% mortality respectively of *T. tabaci,* after 5 days of treatment. This result was concurred to the findings of Gajera *et al.* (2009) [5], who found that the application of *B. bassiana* 1.15% WP@ 7g/liter and *B. bassiana* 1.15% WP@ 8g/liter recorded 95.33 and 97.71% mortality, respectively and it was decreased with decreasing dose of *B. bassiana* 1.15% WP for effective management of *T. tabaci* in garlic under laboratory condition. The present study signposted that higher dose (7g/liter) of *B. bassiana* 1.15% WP prove to be the most effective against *T. tabaci* in onion, and it was found at par with *B. bassiana* 1.15% WP @5 and 6g/liter, which recorded 90.00% mortality. The lower doses of *B. bassiana* 1.15% WP (4 and 3 g/liter) showed comparatively lower effect than higher doses. This statement was confirmed by Patil *et al.* (2016) [6], who elucidated that *B. bassiana* 1.15% WP @7.5 g/lit and 5 g/lit were found effective to control *T. tabaci*. 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 workers.

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

Sr. No.	Treatments (Dose/liter)	Per cent mortality		
		1 DAT	3 DAT	5 DAT
1.	*B. bassiana* 1.15% WP @3 g	9.10* (0.00)	18.43(10.00)	39.23(40.00)
2.	*B. bassiana* 1.15% WP @4 g	12.07 (2.50)	26.55(20.00)	50.77(60.00)
3.	*B. bassiana* 1.15% WP @5 g	20.70 (12.50)	39.23(40.00)	71.62(90.00)
4.	*B. bassiana* 1.15% WP @6 g	22.76 (15.00)	40.69(42.50)	71.62(90.00)
5.	*B. bassiana* 1.15% WP @7 g	24.73 (17.50)	45.00(50.00)	73.90(92.50)
S. Em.±		0.35	0.41	1.28
C.D. at 5%		1.05	1.23	3.86
C.V.%		3.96	2.42	4.18

*Data in the parentheses are original values, while outside values are arcsine transformed.
DAT = Day after treatment. Local strain of *B. bassiana* @2x10^6cfu/g was used

Summary and Conclusion

The *B. bassiana* at each five doses resulted superior in case of thrips over check. The *B. bassiana* 1.15% WP @7 g/liter caused the highest mortality of 92.50% and it was at par with *B. bassiana* 1.15% WP @6 g/liter and *B. bassiana* 1.15% WP @5 g/liter, which both caused 90.00% mortality. The remaining lower doses of 4 and 3 g/liter expressed inferior results. Considering the efficacy along with cost of effective doses, the B. bassiana 1.15% WP @5 g/liter was found the most effective dose against *T. tabaci.*

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