Verification of Efficacy of Bitoxybacillin/ *Bacillus thuringiensis* on Red Spider Mite, *Tetranychus urticae* on Cut Roses

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**ARTICLE INFO**

Article history
Received: 1 December 2020
Revised: 7 December 2020
Accepted: 8 December 2020
Published Online: 30 December 2020

**ABSTRACT**

Cut roses industries, new income resource in Ethiopia, most of flower industries are established near and around Addis Ababa city, especially in west and east Shewa zones, most of flower enterprise established by foreigner, which enhances global economy and creates job opportunities. Red spider mite, *Tetranychus urticae* is the major obstacles for flower production here in Ethiopia, in order to increase the quality and quantity of flower production need to plan different control strategies. Objective of this study was to evaluate the efficacy of these naturally occurring bacteria in controlling the red spider mite in rose flower farms. This experiment was donning on Menagesh, Gallica flower farm and the variety was Limbo flower, the application time was at flowering stage. Two rounds at the rate of 7ml/l by using Motorized knapsack sprayer for four consecutive months. The analysis of variance on mite count data after the application of Bitoxybacillin (Bt) and Abamectin 1.8%EC showed no significant difference (p>0.05) even after 21 days after the second spray (Table 1). However, the population density of the spider mite in Bt treated plots was very low in all sampling dates compared to the untreated check and Abamectin. The pest population (original data) after three weeks of the Bitoxybacillin applications was 68.1 per stem compared to Abamectin 1.8%EC (125.1) and control (110.57) indicating the registered miticide failed to suppress the mite population in roses. Bitoxybacill, would be advisable to have it registered in Ethiopia as alternative synthetic miticides for the control of red spider mite in Integrated Pest Management (IPM) program.

**Keywords:**
Bitoxybacillin  
Red spider mite  
Cut roses  
West and east Shewa  
Ethiopia

**1. Introduction**

Cut flowers are becoming very important and many flower farms have been established in west and east Shewa zones. The enterprise plays an important role in the global economy and creates jobs and earns the much-desired foreign currency to the country. The area under flower farms is increasing and the area coverage is estimated to be around 1000 ha.

Two-spotted spider mite, *Tetranychus urticae* Koch is among the major bottleneck of flower production through-out the world. It is widely distributed and troublesome species recorded in Ethiopia [1]. All active stages (adults and nymphs) remove plant sap (undersurface of the leaves) causing tiny light spots (with speckled appearance). Loss in yield occurs when 30% of the leaf area damaged by spider mite [2,3]. Infestations will reduce the quality of cut flowers, and in case of severe infestations, the entire plant may die.

Acaricides have provided the major means of controlling infestations on mites and it is indisputable that

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**DOI:** https://doi.org/10.36956/rwae.v1i1.240
they have played a major role in flower production and is likely to do so for at least the foreseeable future. Since the establishment of these farms, a very wide range of different acaricides has been used to control the pest. These include dusting sulfur, Abamectin, Mitac, Dicofol, Apollo and many more. However, the repeated use of some products led to a build-up of resistance in mite population. This has resulted in a decrease in effectiveness of treatments that have been reported in Ethiopia in such a short period of time. Therefore, the development of alternative management strategies becomes paramount and the use of biological control agent’s vis-à-vis microbial agents, parasitoids and predators. Predatory mites such as *Phytoseiuluspersimilis* and *Amblyseiuscalifornicus* were introduced to control spider mite in some flower farms[^4].

Thus there is an immediate need to change current crop protection strategies to ones that are based upon the use of IPM, rather than relying solely on pesticides.

*Bacillus thuringiensis* is a ubiquitous, gram-positive and spore-forming bacterium. During sporulation, it produces intracellular crystal proteins (cry proteins), which are toxic to insects. Because of its insecticidal activity, it has been used for nearly fifty years to control certain insect species among the orders Lepidoptera, Coleoptera, and Diptera. The natural insecticide produced by the bacterium *Bacillus thuringiensis* (called “Bt”) has been used for decades by farmers to control insect pests and by the World Health Organization to kill mosquitoes without using dangerous chemical pesticides. The Bt is produced throughout the world and sold as a biological control agent in most countries where horticultural crops are grown. In 1995, worldwide sales of *B. thuringiensis* based insecticides were estimated at $90 million representing about 2% of the total global insecticide market[^5,6]. Therefore, the objective of study is to evaluate the efficacy of these naturally occurring bacteria in controlling the red spider mite in rose flower farms.

### 2. Materials and Methods

**Location:** Menagesha, Gallica flower farm  
**Variety:** Limbo  
**Crop stage when bio-pesticide is applied:** flowering  
**Target pest (Red spider mite, *Tetranychusurticae* Koch)**  
**Trade Name:** Bitoxybacillin  
**Scientific Name:** *Bacillus thuringiensis*  
**Formulation:** *Bacillus thuringiensisvarthuringiensis* bacterial spore (powder form)  
**Manufacturer:** Sibbiopharm Ltd.  
**Dosage and frequency:** Two rounds at the rate of 7ml/L.  
**Application technique and duration:** Motorized knapsack sprayer  
**Duration:** Four months- Starting date: September 2016  
**Ending date:** December 2016  

**Research on World Agricultural Economy**  |  **Volume 01** |  **Issue 01** |  **December 2020**  

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[^5]: Reference 5
[^6]: Reference 6

The result is summarized in Table 1. The analysis of variance on mite count data after the application of Bitoxybacillin (Bt) and Abamectin 1.8%EC showed no significant difference (p>0.05) even after 21 days after the second spray (Table 1). However, the population density of the spider mite in Bt treated plots was very low in all sampling dates compared to the untreated check and Abamectin. The pest population (original data) after three weeks of the Bitoxybacillin applications was 68.1 per stem compared to Abamectin 1.8%EC (125.1) and control (110.57) indicating the registered miticide failed to suppress the mite population in roses. The first two post spray counts of the spider mite also showed similar trend. The frequency of application of the bio-agent needs to be investigated in order to determine its economic optimum use as integrated management of the pest. Although there has been no significant difference among the treatments, the pest population was clearly reduced and kept below the threshold level in Bt treated plots compared to Abamectin 1.8%EC (1.14ml/l) and untreated control (Figure1).

### 3. Results

The result is summarized in Table 1. The analysis of variance on mite count data after the application of Bitoxybacillin (Bt) and Abamectin 1.8%EC showed no significant difference (p>0.05) even after 21 days after the second spray (Table 1). However, the population density of the spider mite in Bt treated plots was very low in all sampling dates compared to the untreated check and Abamectin. The pest population (original data) after three weeks of the Bitoxybacillin applications was 68.1 per stem compared to Abamectin 1.8%EC (125.1) and control (110.57) indicating the registered miticide failed to suppress the mite population in roses. The first two post spray counts of the spider mite also showed similar trend. The frequency of application of the bio-agent needs to be investigated in order to determine its economic optimum use as integrated management of the pest. Although there has been no significant difference among the treatments, the pest population was clearly reduced and kept below the threshold level in Bt treated plots compared to Abamectin 1.8%EC (1.14ml/l) and untreated control (Figure1).

**Table 1.** Mean pre- and post spray mite count per stem of cut flower (transformed data, $\sqrt{(0.5+n)}$)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Pre-spray count</th>
<th>1st spray post count</th>
<th>2nd spray post count</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4DAS*</td>
<td>10DAS</td>
<td>5DAS</td>
</tr>
<tr>
<td>Bitoxybacillin</td>
<td>2.1A</td>
<td>1.82A</td>
<td>2.0A</td>
</tr>
<tr>
<td>Abamectin 1.8%EC</td>
<td>2.2A</td>
<td>2.32A</td>
<td>2.9A</td>
</tr>
<tr>
<td>Untreated check</td>
<td>2.2A</td>
<td>4.67A</td>
<td>3.7A</td>
</tr>
</tbody>
</table>

**LSD(0.05)**  
NS  
CV  
46.6  
31.4  
37.9  
21.1  
41.6  
18.8

**Note:** *DAS=Days after Spray*  

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[^1]: Reference 1
[^2]: Reference 2
[^3]: Reference 3
[^4]: Reference 4
[^5]: Reference 5
[^6]: Reference 6
Figure 1. Post spray spider mite count per stem after 5, 12 and 21 days (transformed data)

Note: *DAS=Days after Spray

4. Recommendation(s)

Bitoxybacillin has a long history of success worldwide and has been registered for use on different insect pests of economic importance (caterpillars, aphids etc), it would be advisable to have it registered in Ethiopia as a relatively safe alternative to synthetic miticides for the control of red spider mite in IPM Program.

References