

Efficacy of imidacloprid against jassids in sprayed transgenic and non-transgenic cotton

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Abstract

Cotton crop is one of the most important cash crop in the World. Transgenic cotton was developed against the target pests lepidopteran, but it can also affect the non-target insects which are sucking pests. In this study transgenic cotton was tested against sucking pest jassids in sprayed and non-sprayed conditions under laboratory conditions. Mortality tests were conducted for jassids adults in petri dishes, sprayed with imidacloprid on transgenic cotton leaves in comparison to control. Results showed that mortality was higher in high concentration sprayed transgenic cotton as compared to control in all three mortality tests. While it was moderate at recommended dose in all three mortality tests. Mortality was lowest in low concentration. These results showed that jassids did not developed resistance when sprayed on transgenic and non-transgenic cotton with imidacloprid.

Keywords: jassids, Bt cotton, imidacloprid, resistance development

Introduction

Cotton (*Gossypium hirsutum* L) is the most valuable cash crop of Pakistan, which is grown on 2.879 million hectares and is the rootage of big quantity of abroad exchange, tributary about 7.0 percent of value added in agriculture and about 1.5 percent of GDP and tributary about 66.50 percent share in national oil production (Anonymous, 2013) [7]. Seed sack of cotton plays an important role in the animal feed and organic muck (Chidda, 1997) [12]. In 2007 crop of cotton was grown above an area of 3054 thousand hectare with the yield of 11655 thousands bale (Anonymous, 2008) [6]. Pakistan have fourth position in the ranking of cotton yield after China, USA and India (Abro, 2004) [1]. Cotton is a basal source of edible oil and natural fiber (Hassan and Shafique, 2010) [15].

Transgenic cotton that produces insecticidal proteins from the bacterium *Bacillus thuringiensis* (Bt) can control some major pests and can help to decrease reliance on insecticide sprays (Sanahuja *et al.* 2011) [27]. Transgenic cotton that expresses Cry protein that are increasingly successful in the management of insect pests (Schnepf *et al.* 1998) [28]. This Bt crops were commercialized in 1996 and covered almost 66 million hectares worldwide in 2011 (James, 2011) [19]. Genetically engineered crop of cotton produced toxin Cry 1Ac which kill the larvae of some major insect pest specially lepidopterans, Transgenic cotton was grown on >1 million hectares in the United states in 1998 (James 1998) [18]. Cotton crop considered as most important crop of Egypt.

Cotton plant is damaged through different insects in its growth. In recent years sucking insect pest just like jassid play an important role for damage the cotton crop. Jassids suck the cell sap of plant tissue and leaf. Sometime due to severe damage it is necessary to re-sow the crop (Salama *et al.* 2006)

[25]. The new chemistry insecticide are used for controlling of jassid. The per year current market share of new chemistry insecticide above to 600 million Euro, imidacloprid include as a biggest selling pesticide worldwide (Jemec *et al.* 2007) [20]. The important purpose of new chemistry insecticide is that they help in continuous plant protection throughout a crop life. Systemic pesticide are are not disposed through ultra violet light degradation, they are not easily wash off from the plant because they become a part of a plant (Herbert *et al.* 2008) [16]. Cotton commonly known as silver fiber is the backbone of our country. Cotton has many uses and gives up to 63.3% to our foreign exchange earnings (Anonymous, 2003-04) [4, 5]. The cotton Area has continuously increased from 2983 million hectares in 1999-2000 to 2989 million hectares in 2004. Yield of cotton crop has decreased from 641 kg in the previous year to last year (Anonymous, 2003-04) [4, 5]. This cotton production is still very low as compared to other cotton growing countries of the world. The main factor of low yield is insect attack.

In Pakistan 93 insects have been reported on cotton crop (Yunus and Yousuf, 1979) [30]. 5-10 % average crop damage every year. At the time of severer attack loss percentage increase up to 30-40%, in some case total loss might happen (Huque, 1972) [17]. The major important sucking pest of cotton is jassid white fly and thrips, they start attack from early stage and continue till to maturity. Cotton crop face considerable attack of sucking insect pest from early stage till to maturity. They damage the life and decrease the plant life, which cause the less no of flower and boll and finally reduce the crop yield. 40-50% crop loss occurs due to attack of

sucking insect pest of cotton (Naqvi, 1976). Due to favorable environment condition cause the total damage of crop (Yunus *et al.* 1980). Jassid can be controlled with the help of conventional insecticide and new chemistry insecticide just like imidacloprid (Atique and Rashid (1983) ^[10], Ahmad and Baig (1987) ^[2], Ahmed and Hasan (1993) ^[3], Tufail *et al.* (1995) ^[29], Attique and Ghaffar (1996) ^[11], Hamed *et al.* (1997) ^[14], Naimatullah *et al.* (1998) ^[22], Saleem and Khan (2001) ^[26], Saleem *et al.* (2001) ^[26]. In the current study, new chemistry insecticide imidacloprid have been used for the controlling of jassid.

Material and Method

Experimental Design

The experiment was conducted at Postgraduate laboratory, Department of Entomology, University of Agriculture, Faisalabad by using the Completely Randomized design (CRD) consisting of three treatments having three. In each treatment twenty petri-dishes were used. The jassid were collected from the field and reared under the laboratory conditions temp (26±2) °C and relative humidity (60±5%)

Mortality % = No of adults died / Total no of adults × 100

Results

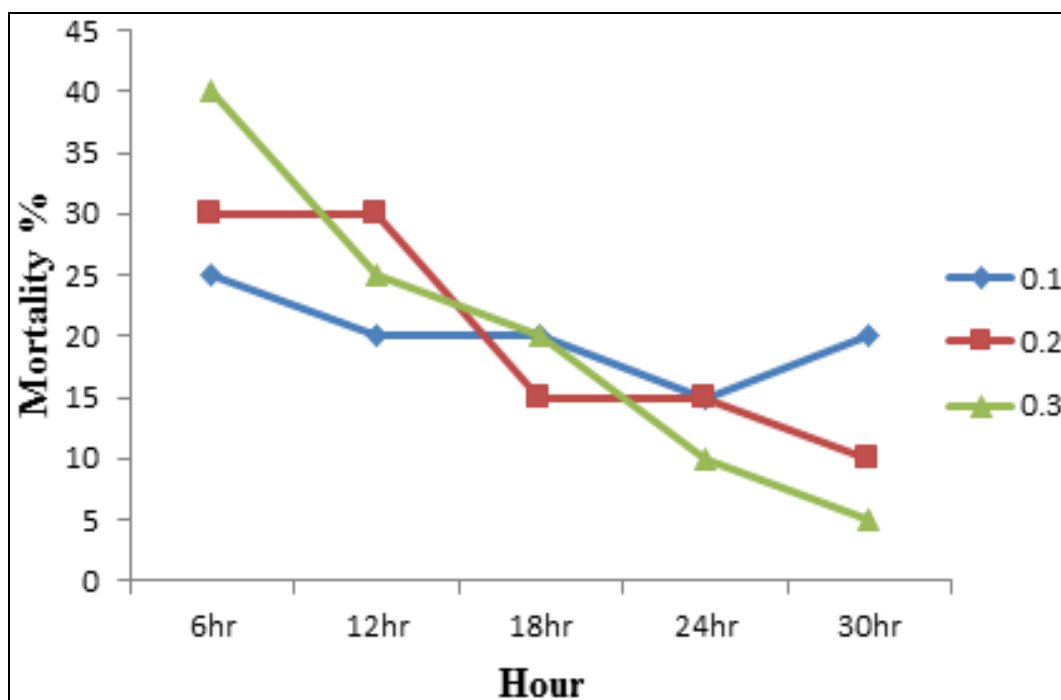


Fig 1

Mortality test results in (Fig 1) showed that after the application of Imidacloprid @ 0.1% maximum mortality of jassid was (25%) after 6 hour while minimum (15%) was after 24 hour. While in case of Imidacloprid @ 0.2% maximum mortality of jassid was (30%) after 6 and 12hour while minimum (10%) after 30 hour. While in case of imidacloprid

without the exposure of insecticides. Jassid population was maintained on cotton leaves.

Insecticide Preparation and Applications

Imidacloprid @ 0.1%, 0.2% and 0.3% was tested against the jassid population under the laboratory conditions. The stock solution of tested pesticide was prepared and different required concentrations were formed. Water was used as Control treatment. In each mortality test control treatment was used for comparison between treated and untreated application.

Mortality tests of cotton jassid

Three mortality tests were conducted by using the Imidacloprid with three different concentrations viz. 0.1%, 0.2% and 0.3%. In each petri-dish one jassid with one treated cotton leaf. The prescribed concentration of pesticide was applied on cotton leaf by using the atomizer. The same procedure was performed for other treatments. The data regarding the mortality % of jassid was taken for consecutive 30 hour. Mortality % of adult jassid was calculated by using the following prescribed formula

@ 0.3% maximum mortality of jassid was (40%) after 6hour while minimum mortality was (5%) after 30 hour. While Overall results showed that there is significant difference in mortality % of Jassid on 0.1% and 0.2% concentration as compared to 0.3% concentration. As (df) = 2, (F) = 0, (P-value) = 0.022414.

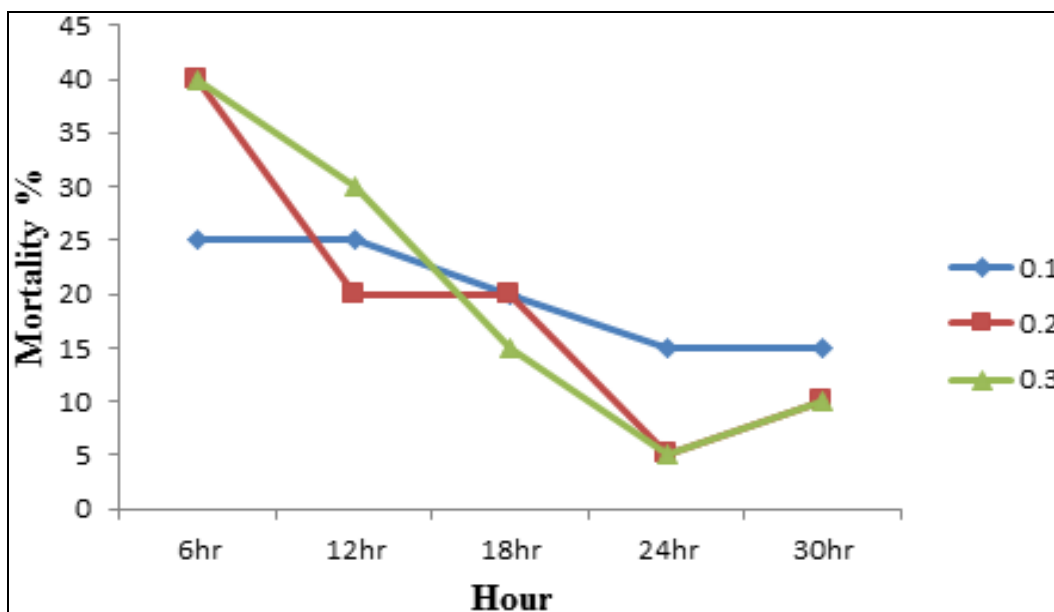


Fig 2

Mortality test results in (Fig 2) showed that after the application of Imidacloprid @ 0.1% maximum mortality of jassid was (25%) after 6 and 12 hour while minimum (15%) was after 24 and 30 hour. While in case of Imidacloprid @ 0.2% maximum mortality of jassid was (40%) after 6 while minimum (5%) after 24 hour. While in case of imidacloprid @

0.3% maximum mortality of jassid was (40%) after 6hour while minimum mortality was (5%) after 24 hour. While Overall results showed that there is significant difference in mortality % of Jassid on 0.1% and 0.2% concentration as compared to 0.3% concentration. As (df) = 2, (F) = 0.044944, (P-value) = 0.004272

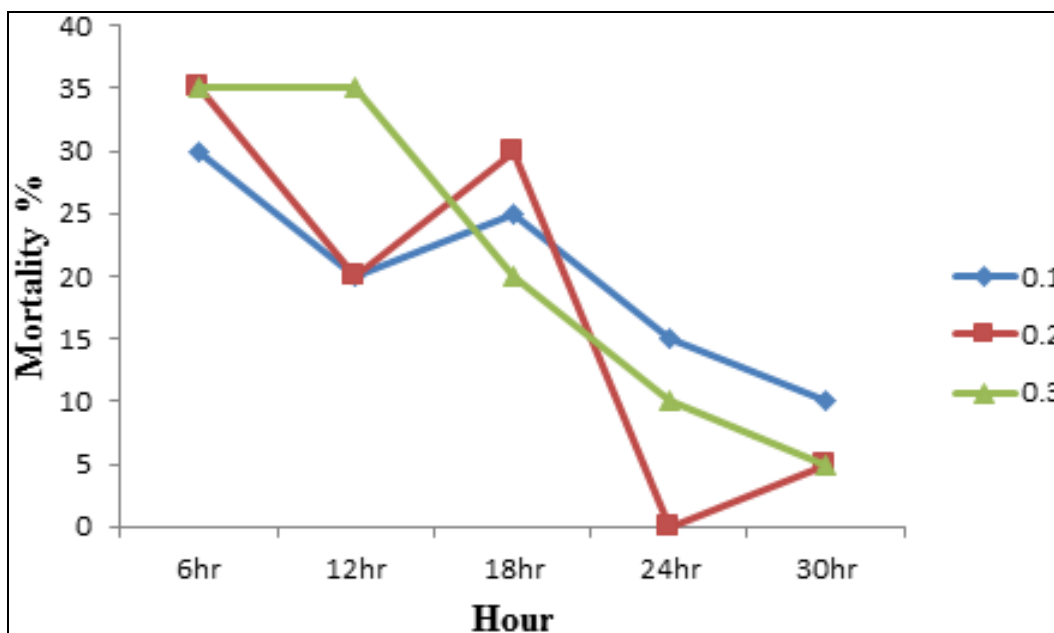


Fig 3

Mortality test results in (Fig 3) showed that after the application of Imidacloprid @ 0.1% maximum mortality of jassid was (30%) after 6 while minimum (10%) was after 30 hour. While in case of Imidacloprid @ 0.2% maximum mortality of jassid was (35%) after 6 hour while minimum (0%) after 24 hour. While in case of imidacloprid @

0.3% maximum mortality of jassid was (35%) after 6hour and 12 hour while minimum mortality was (5%) after 30 hour. While Overall results showed that there is significant difference in mortality % of Jassid on 0.1% and 0.2% concentration as compared to 0.3% concentration. As (df) = 2, (F) = 0.054054, (P-value) = 0.002099

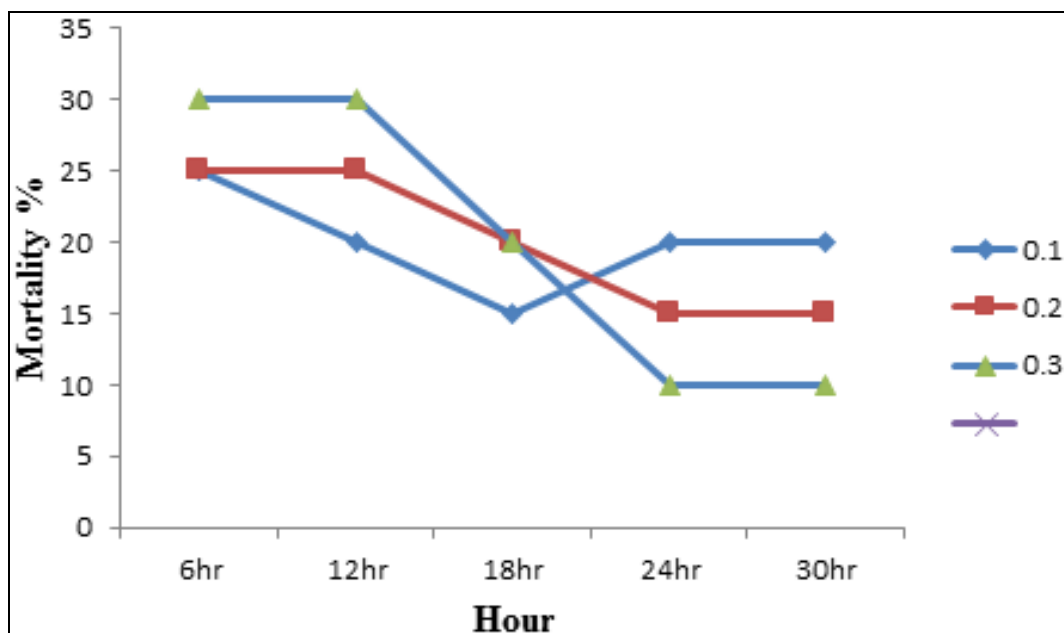


Fig 4

Mortality test results in (Fig 4) showed that after the application of Imidacloprid @ 0.1% maximum mortality of jassid was (25%) after 6 while minimum (15%) was after 18 hour. While in case of Imidacloprid @ 0.2% maximum mortality of jassid was (25%) after 6 and 12 hour while minimum (15%) after 24 and 30 hour. While in case of imidacloprid @ 0.3% maximum mortality of jassid was (30 %) after 6hour and 12 hour while minimum mortality was (10%) after 24 and 30 hour. While Overall results showed that there is significant difference in mortality % of Jassid on 0.1% and 0.2% concentration as compared to 0.3% concentration. As (df) = 2, (F) = 0, (P-value) = 0.045267.

Discussion

The obtained results are discussed in regards of effect of different concentration of insecticides especially imidacloprid on cotton jassid (*Amrasca biguttula*). Our results shows that higher concentration of insecticides was more effective for the control of cotton jassid as compare to the standard and low concentration. Low concentration of imidacloprid was less effective for the control of *Amrasca biguttula*. Our findings was in complete conformity with those of Tufail *et al.* (1995) [29], who described that imidacloprid have a very effective for the control of sucking insects pest especially cotton jassid. Our results was in agreement to Naimatullah *et al.* (1998) [22] who reported that different insecticides including imidacloprid shows considerable effect for suppressing the sucking insect pest e.g. *Amrasca biguttula*, *Aphis gossypie* and *Bemisia tabaci*.

These results was in similarity to Saleem and Khan (2001) [26], who described that these insecticides was very prominent for the control of the cotton jassids as in our results from imidacloprid different concentrations higher concentration was most effective. Niggar and Zidan, 2013 who reported that treatment with different insecticides, imidacloprid and thiamethoxam were extremely effective against aphids and jassids, while the effect was moderate on the whitefly

population. Imidacloprid had more enduring effect than thiamethoxam against jassids. These results were in agreement to our research.

Higher concentration of imidacloprid was most effective for jassid control. These results were in agreement to the Misra (2002) [21] who described that imidacloprid as well as thiamethoxam showed significantly higher in controlling jassids and aphids.

Razaq *et al.* (2003) [24] proved that imidacloprid were highly effective against cotton jassids (*Amrasca biguttula* Ishida) after the application of insecticides at different time interval e.g. at 72, 96 and 240 hrs. Our results were in conformity to above results.

Our results were in agreement to Asi *et al.* (2008) [8] who observed that imidacloprid application was highly effective against cotton whiteflies (*Bemisia tabaci*) and jassids (*Amrasca biguttula*) provide control up to 168 hours. El-Dewy (2006) [13] stated that imidacloprid (confidor) proved to be very effective compound against jassids and whitefly these results was in conformity to our results as we described that imidacloprid different concentration was used to check their effectiveness against cotton jassids. Higher concentration of insecticides was more effective as compare to other concentrations including (lower and standard) for the control of Cotton jassids (*Amrasca biguttula*).

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