



## **Bio-Efficacy of Different Insecticides against Thrips (*Scirtothrips dorsalis* Hood) and Whitefly (*Bemisia tabaci* Gennadius) on BT Cotton**

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### **ABSTRACT**

Field evaluation of new insecticidal molecules i.e. neonicotinoids was conducted against thrips and whiteflies on Bt cotton. The new molecules tested were imidacloprid 17.8 SL 0.004 per cent, acetamiprid 20 SP 0.002 per cent, 25 per cent WG 0.005 per cent, clothianidin 50 WDG 0.01 per cent, fipronil 5 SC 0.015 per cent, diafenthiuron 50 WP 0.060 per cent, dimethoate 30 EC 0.04 per cent. Fipronil recorded significant superior in reducing thrips population which was on par with diafenthiuron followed by other insecticides up to 14 days after first and second spray. Fipronil recorded the lowest number of whiteflies in cotton ecosystem followed by acetamiprid and other treatments up to 14 days after third spray.

**Keywords:** *Scirtothrips dorsalis* Hood, *Bemisia tabaci* Gennadius, BT COTTON

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### **INTRODUCTION**

Cotton is most important commercial crop known as “king of natural fiber” and world over commonly referred as “white gold” which belongs to family Malvaceae and genus *Gossypium*. Cotton plays an important role in strengthening economy of 82 countries across the world [1-5].

Cotton was cultivated in about 35.7 M hectares area across the world and in about 12.2 M hectares area in India. During 2014-15, the total cotton production in India was 400.00 lakh bales of 170 kg/bale with average productivity of 537 kg/ha [6]. In Maharashtra cotton was grown in about 41.92 lakh ha area with the production of 85 lakh bales of 170 kg/bale and average productivity of 345 kg/ha during 2014-15 [6]. At national level Maharashtra ranked first in area, second in production and eleventh in productivity [6]. Introduction of Bt cotton technology solved the bollworm problem but continuous cultivation of Bt cotton has at some places led to increased incidence of sucking and other pests in the recent years [7]. The important sucking insect-pests attacking Bt cotton are jassid (*Amrasca biguttula biguttula* Ishida), thrips (*Scirtothrips dorsalis* Hood), aphid (*Aphis gossypii* Glover.), whitefly (*Bemisia tabaci* Gennadius) and mealy bug (*Phenacoccus solenopsis* Tinsley). Among that thrips nymph and adults lacerating the leaf and cause damage to seedling and seedling becomes wrinkled and distorted with white shiny patches; infected older crop presents rusty appearance in the field. Nymphs and adults of whiteflies by sucking cell sap causes upward curling of leaves reduce plant vigour, lint contamination with honey dew and associated fungi and also transmit leaf curl virus disease. Several new groups of insecticides have been recommended against sucking pest complex of cotton. But according to several reports many recommended label claimed insecticides could not ascertain effective results. Hence these label claimed insecticides at existing recommended doses should have to be re-evaluated against sucking pest complex of cotton for effective management.

### **MATERIALS AND METHODS**

The field experiment with cotton crop using variety RCH-2 (BG-II) in Kharif 2014 was conducted at the Research Farm of Department of Agricultural Entomology, college of Agriculture, Latur (Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani) (Maharashtra) India. The experiment was conducted in a randomized block design with eight treatments including untreated control replicated three times. The cotton crop was sown on 30<sup>th</sup> June, 2014 in a gross plot of 7.2 x 4.8 sq. m maintaining net plot of 5.4 x 3.6

sq. m. The row to row distance of 90 cm and plant to plant distance of 60 cm were maintained. The dose of fertilizer at the rate of 60 kg N, 30 kg P<sub>2</sub>O<sub>5</sub>, per hectare was given at the time of sowing.

#### Methods of recording observations

Five observation plants were selected randomly from the net plot of each treatment in each replication. They were labeled properly.

The observations on total number of thrips, *Scirtothrips dorsalis* (Hood) were recorded on top, middle and bottom leaves of five randomly selected plants from each treatment at one day before and 1, 3, 7 and 14 days after application of insecticides.

The observations on total number of whiteflies, *Bemisia tabaci* (Genn.) were recorded on top, middle and bottom leaves of five randomly selected plants from each treatment at one day before and 1, 3, 7 and 14 days after application of insecticides.

#### Statistical analysis

The data in respect of bio-efficacy of different insecticides against *S. dorsalis* and *B. tabaci* were statistically analyzed by standard 'analysis of variance'. The null hypothesis was tested by 'F' test of significance at 5 per cent level [8]. The data on number of thrips were transformed into square root transformation before statistical analysis.

**Table 1: Details of insecticides used in the experiment**

| Sr. No. | Common name   | Trade name and formulation | Chemical name (IUPAC name)  | Group of insecticide |
|---------|---------------|----------------------------|---|----------------------|
| 1       | Imidacloprid  | Confidor 17.8 % SL         | 1-(6-chloro-3-pyridylmethyl)-N-nitroimidazolidin-2-ylideneamine   | Neonicotinoid        |
| 2       | Acetamiprid   | Dhanpreet 30 % EC          | (E)-N <sub>1</sub> -[(6-chloro-3-pyridyl)methyl]-N <sub>2</sub> -cyano-N <sub>1</sub> -methylacetamide.         | Neonicotinoid        |
| 3       | Thiamethoxam  | Actara 25 % WG             | (EZ)-3-(2-chloro-1,3-thiazol-5-ylmethyl)-5-methyl-N-nitro-1,3,5-oxaeliazinan-4-imine.                           | Neonicotinoid        |
| 4       | Clothianidin  | Dentaso % WDG              | 1-[(2-chloro-1,3-thiazol-5yl)methyl]-2-methyl-3-nitroguanidine.   | Neonicotinoid        |
| 5       | Fipronil      | Reagent 5 % SC             | 5-amino-[2,6-dichloro-4-(trifluoroethyl phenyl)-4-(1,R,S)-(trifluoroethyl sulfinyl)-1H-pyrazole-3-carbonitrile. | Phenyl pyrazol       |
| 6       | Diafenthiuron | Polo % WP                  | 1-test-butyl-3-(2,6-di-isopropyl-4-phenylphenyl)thiarea.  | Neonicotinoid        |
| 7       | Dimethoate    | Tagfor 30 % EC             | O,O-Dimethyl S-methylcarbamoylmethyl phosphorodithioate   | Organo phosphate     |

## RESULTS AND DISCUSSION

Populations of thrips recorded are presented in Table 2 and 3.

**Table 2: Effect of different insecticides on the population of cotton thrips (First spray)**

| Treatments                      | Number of thrips per three leaves |                      |                 |                 |                 |
|---------------------------------|-----------------------------------|----------------------|-----------------|-----------------|-----------------|
|                                 | 1 day before treatment            | Days after treatment |                 |                 |                 |
|                                 |                                   | 1                    | 3               | 7               | 14              |
| Imidacloprid<br>0.004 per cent  | 22.54<br>(4.80)*                  | 2.96<br>(1.86)       | 5.59<br>(2.46)  | 8.45<br>(2.99)  | 14.47<br>(3.87) |
| Acetamiprid<br>0.002 per cent   | 21.20<br>(4.66)                   | 2.70<br>(1.79)       | 4.84<br>(2.31)  | 8.07<br>(2.93)  | 13.64<br>(3.76) |
| Thiamethoxam<br>0.005 per cent  | 21.58<br>(4.70)                   | 3.06<br>(1.88)       | 5.91<br>(2.53)  | 8.78<br>(3.04)  | 14.82<br>(3.91) |
| Clothianidin<br>0.010 per cent  | 22.54<br>(4.80)                   | 3.46<br>(1.99)       | 6.66<br>(2.68)  | 9.41<br>(3.15)  | 15.72<br>(4.03) |
| Fipronil<br>0.015 per cent      | 22.34<br>(4.78)                   | 2.33<br>(1.68)       | 4.28<br>(2.18)  | 7.21<br>(2.78)  | 12.22<br>(3.57) |
| Diafenthiuron<br>0.060 per cent | 21.56<br>(4.70)                   | 2.61<br>(1.76)       | 4.67<br>(2.27)  | 7.74<br>(2.87)  | 12.74<br>(3.64) |
| Dimethoate<br>0.04 per cent     | 23.55<br>(4.90)                   | 3.18<br>(1.91)       | 6.24<br>(2.59)  | 9.11<br>(3.10)  | 15.07<br>(3.94) |
| Untreated Control               | 21.52<br>(4.69)                   | 21.74<br>(4.71)      | 22.05<br>(4.74) | 22.51<br>(4.80) | 22.94<br>(4.84) |
| S.E. ±                          | 0.11                              | 0.03                 | 0.03            | 0.04            | 0.04            |
| C.D. at 5per cent               | NS                                | 0.08                 | 0.09            | 0.11            | 0.13            |
| C.V. (per cent)                 | 7.24                              | 3.21                 | 3.76            | 4.69            | 6.11            |

Figures in parentheses are square root transformed values; N.S.- Non significant

**Table 3: Effect of different insecticides on the population of cotton thrips (Second spray)**

| Treatments                      | Number of thrips per three leaves |                      |                 |                 |                 |
|---------------------------------|-----------------------------------|----------------------|-----------------|-----------------|-----------------|
|                                 | 1 day before Treatment            | Days after treatment |                 |                 |                 |
|                                 |                                   | 1                    | 3               | 7               | 14              |
| Imidacloprid<br>0.004 per cent  | 17.12<br>(4.20)*                  | 1.97<br>(1.58)       | 3.12<br>(1.90)  | 6.64<br>(2.67)  | 9.24<br>(3.12)  |
| Acetamiprid<br>0.002 per cent   | 17.02<br>(4.18)                   | 1.84<br>(1.53)       | 2.92<br>(1.85)  | 6.33<br>(2.61)  | 8.92<br>(3.07)  |
| Thiamethoxam<br>0.005 per cent  | 17.79<br>(4.28)                   | 2.14<br>(1.63)       | 3.48<br>(1.99)  | 6.91<br>(2.72)  | 10.01<br>(3.24) |
| Clothianidin<br>0.010 per cent  | 18.47<br>(4.35)                   | 2.95<br>(1.85)       | 4.16<br>(2.16)  | 7.49<br>(2.83)  | 10.68<br>(3.34) |
| Fipronil<br>0.015 per cent      | 15.63<br>(4.02)                   | 1.25<br>(1.33)       | 2.53<br>(1.74)  | 5.57<br>(2.46)  | 7.55<br>(2.84)  |
| Diafenthiuron<br>0.060 per cent | 16.03<br>(4.06)                   | 1.45<br>(1.39)       | 2.70<br>(1.79)  | 5.70<br>(2.49)  | 8.04<br>(2.92)  |
| Dimethoate<br>0.04 per cent     | 18.04<br>(4.30)                   | 2.47<br>(1.72)       | 3.55<br>(2.01)  | 7.11<br>(2.76)  | 10.14<br>(3.26) |
| Untreated Control               | 23.17<br>(4.86)                   | 23.42<br>(4.89)      | 23.78<br>(4.92) | 24.08<br>(4.96) | 24.53<br>(5.00) |
| S.E. $\pm$                      | 0.14                              | 0.02                 | 0.02            | 0.03            | 0.04            |
| C.D. at 5per cent               | NS                                | 0.06                 | 0.07            | 0.09            | 0.11            |
| C.V. (per cent)                 | 6.12                              | 4.18                 | 3.54            | 4.17            | 5.08            |

Figures in parentheses are square root transformed values

N.S.- Non significant

The precount was non-significant showing even distribution and mean data on survival (1, 3, 7 and 14 DAS) after first spray indicated that all the insecticidal treatments were significantly superior. The average number of thrips observed in all plots ranging from 21 to 23. The fipronil 0.015 per cent (2.33 thrips per three leaves) and Diafenthiuron 0.060 per cent (2.61 thrips per three leaves) were significantly superior treatments. The next effective treatments were acetamiprid 0.002 per cent (2.70 thrips per three leaves), imidacloprid 0.004 per cent (2.96 thrips per three leaves), thiamethoxam 0.005 per cent (3.06 thrips per three leaves) and dimethoate 0.04 per cent (3.26 thrips per three leaves) are effective, the clothianidin 0.010 per cent (3.46 thrips per three leaves) respectively.

The average number of thrips observed before the second spray from 15 to 18 in all plots. The fipronil 0.015 per cent (1.25 thrips per three leaves) and Diafenthiuron 0.060 per cent (1.45 thrips per three leaves) were significantly superior treatments. The next efficient treatments were acetamiprid 0.002 per cent (1.84), imidacloprid 0.004 per cent (1.97), thiamethoxam 0.005 per cent (2.14) and dimethoate 0.04 per cent (2.47) are effective, the clothianidin 0.010 per cent (2.95).

The overall result of first and second spraying indicated that fipronil 5SC @ 0.015 per cent was most effective in reducing thrips population. The insecticides treatments diafenthiuron 50 WP @ 0.060 per cent, acetamiprid 20SP @ 0.002 per cent, imidacloprid 17.8SL 0.004 per cent and thiamethoxam WG @ 0.005 per cent were the next treatments in diminishing thrips population.

The result on the effectiveness of insecticides against thrips infesting cotton in the present investigation is in accordance with Agale *et al.* [2] observed acetamiprid 20 SP was the most effective treatment in controlling thrips followed by thiamethoxam 25 WG, spinosad 45 SC and imidacloprid 17.8 SL. Whereas, Zanwar *et al.* [9] documented effectiveness of fipronil 40 per cent + imidacloprid 200 SL at the rate of 100 ml/ha and fipronil 5 per cent SC at the rate of 800 g/ha against cotton thrips. However, Bhamare and Wadnerkar [5] demonstrated that acetamiprid 20 per cent SP (20 g a.i./ha) was significantly effective insecticide against cotton thrips. In the studies of Badgujar *et al.* [4] fipronil 5 SC was found significantly superior against cotton thrips followed by acetamiprid 20 SP and thiamethoxam 25 WG. Thus the present findings are in line with these findings.

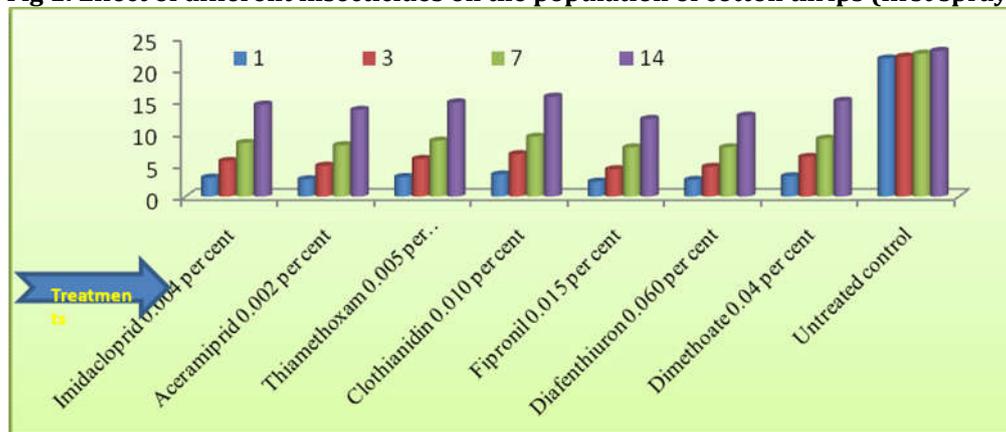
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The precount was non-significant showing even distribution and mean data on survival (1, 3, 7 and 14 DAS) after third spray indicated that all the insecticidal treatments were significantly superior. The average number of whiteflies from 20 to 22 observed in all plots. Among the all treatments fipronil 0.015 per cent (2.35 whiteflies per three leaves) and acetamiprid 0.002 per cent (2.78 whiteflies per three leaves) was significantly superior treatments in reducing whitefly population up to 14 days after third spraying. The next efficient treatments were imidacloprid 0.004 per cent (2.97 whiteflies per three leaves), diafenthiuron 0.060 per cent (3.18 whiteflies per three leaves), thiamethoxam 0.060 per cent

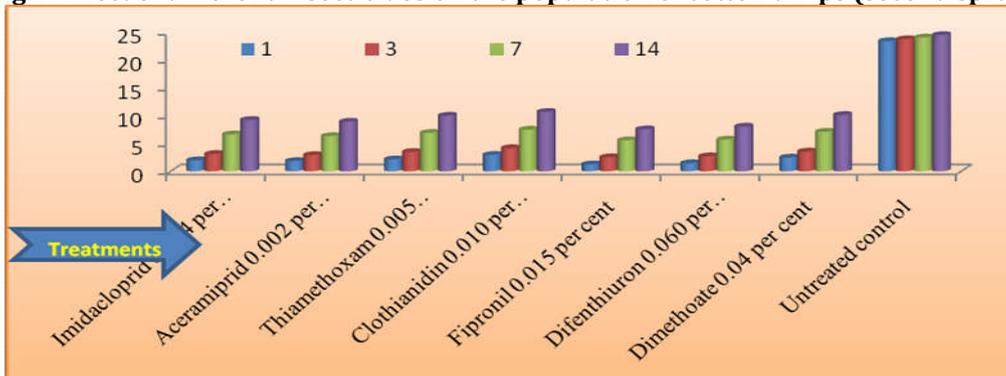
(3.60 whiteflies per three leaves), dimethoate 0.04 per cent (3.85 whiteflies per three leaves) and clothianidin 0.010 per cent (4.16 whiteflies per three leaves).

Anjum Ali *et al.* [3] proved that acetamiprid, diafenthiuron and imidacloprid were effective insecticides against cotton whiteflies.. However, Kalyan *et al.* [10] reported that spinosad, imidacloprid, acephate and fipronil were effectively control the population of cotton whiteflies.

**Fig 1: Effect of different insecticides on the population of cotton thrips (first spray)**



**Fig 2: Effect of different insecticides on the population of cotton thrips (second spray)**

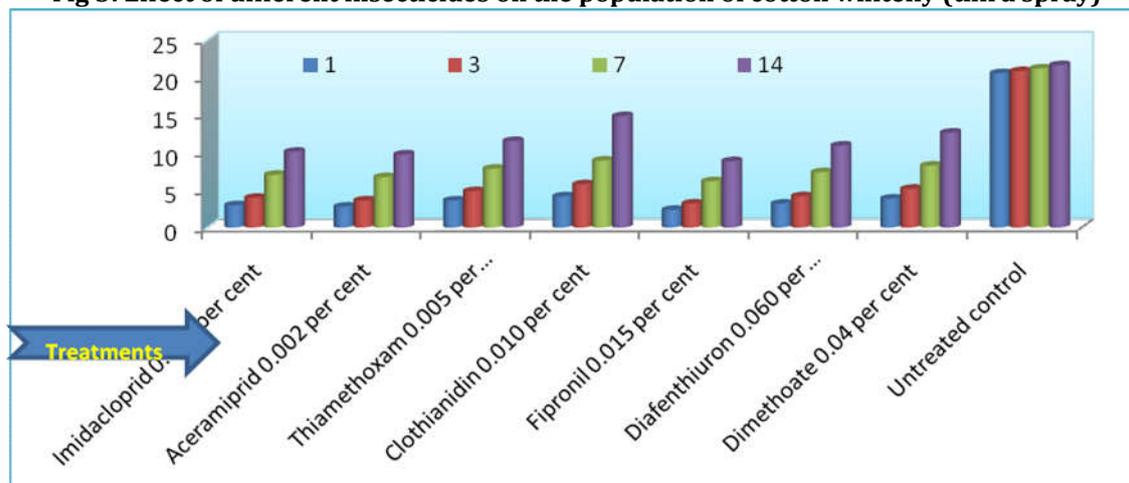


Populations of whitefly recorded are presented in Table 4.

**Table 4: Effect of different insecticides on the population of cotton whitefly (Third spray)**

| Treatments                   | Number of whiteflies per three leaves |                      |                 |                 |                 |
|------------------------------|---------------------------------------|----------------------|-----------------|-----------------|-----------------|
|                              | 1 day before Treatment                | Days after treatment |                 |                 |                 |
|                              |                                       | 1                    | 3               | 7               | 14              |
| Imidacloprid 0.004 per cent  | 21.28<br>(4.67)*                      | 2.97<br>(1.87)       | 3.96<br>(2.11)  | 7.03<br>(2.74)  | 10.11<br>(3.25) |
| Acetamiprid 0.002 per cent   | 20.45<br>(4.58)                       | 2.78<br>(1.81)       | 3.61<br>(2.02)  | 6.72<br>(2.69)  | 9.75<br>(3.20)  |
| Thiamethoxam 0.005 per cent  | 20.24<br>(4.55)                       | 3.60<br>(2.03)       | 4.85<br>(2.32)  | 7.85<br>(2.89)  | 11.55<br>(3.47) |
| Clothianidin 0.010 per cent  | 21.39<br>(4.68)                       | 4.16<br>(2.15)       | 5.76<br>(2.50)  | 8.94<br>(3.07)  | 14.87<br>(3.92) |
| Fipronil 0.015 per cent      | 20.32<br>(4.56)                       | 2.35<br>(1.68)       | 3.19<br>(1.92)  | 6.18<br>(2.58)  | 8.85<br>(3.06)  |
| Diafenthiuron 0.060 per cent | 20.42<br>(4.57)                       | 3.18<br>(1.91)       | 4.17<br>(2.20)  | 7.38<br>(2.81)  | 10.94<br>(3.38) |
| Dimethoate 0.04 per cent     | 21.34<br>(4.67)                       | 3.85<br>(2.08)       | 5.16<br>(2.38)  | 8.26<br>(2.96)  | 12.67<br>(3.62) |
| Untreated Control            | 20.30<br>(4.56)                       | 20.61<br>(4.59)      | 20.89<br>(4.63) | 21.24<br>(4.66) | 21.68<br>(4.70) |
| S.E. ±                       | 0.27                                  | 0.02                 | 0.03            | 0.03            | 0.03            |
| C.D. at 5 per cent           | NS                                    | 0.07                 | 0.09            | 0.10            | 0.13            |
| C.V. (per cent)              | 6.63                                  | 3.41                 | 4.28            | 5.68            | 6.27            |

\*Figures in parentheses are square root transformed values ( $\sqrt{x + 0.5}$ ) N.S.- Non significant.

**Fig 3: Effect of different insecticides on the population of cotton whitefly (third spray)****ACKNOWLEDGEMENTS**

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