**Original Research Article**

**Efficacy of certain newer insecticides against thrips, *Thrips tabaci,* on cotton under High Density Planting System**

**Evaluating efficacy of Novel Insecticides against *Thrips tabaci,* under High Density Planting System on Cotton**

**ABSTRACT**

The present investigation was carried out in Siddhapur farm of RARS, Warangal during *kharif,* 2024, to evaluate the efficacy of different newer insecticides *viz.,* Isocycloseram 9.2% DC, Cyantriniprole 10.6% OD, Chlorfenapyr 240 SC, Flonicamid 50 WG, Tolfenpyrad 15% EC, and Fipronil 5% SC against thrips population in cotton ecosystem along with an untreated control. After two insecticidal sprays, the highest reduction of thrips population over the untreated control was recorded in Isocycloseram 9.2% DC treatment with 88.3 per cent followed by Fipronil 5% SC with 80.3 per cent and Flonicamid 50 WG with 75.9 per cent and lowest reduction was recorded in Tolfenpyrad 15% EC with 52.7 per cent. Among all the insecticides tested, Fipronil 5% SC recorded the highest benefit-cost ratio of 5.90:1, followed by Flonicamid 50 WG (5.56:1). The treatment demonstrated viability in overseeing thrips of cotton in high-density planting systems.

**Key words**: Efficacy, insecticides, thrips, cotton, benefit-cost ratio

**Introduction**

Cotton holds a prestigious position as a major fiber commodity both domestically and internationally. For many nations, including India, cotton, also referred to as the "King of fiber" and "white gold". Cotton, seed-hair fibre of several species of plants of the genus *Gossypium*, belonging to the family Malvaceae. Cotton supports the cotton textile industry in India, which generates more than a thousand crore rupees worth of cloth annually, and gives millions of farmers and laborers a means of subsistence (Mayee *et al.*, 2004). Telangana state occupies an area of 18.22 lakh hectares with production of 50.80 lakh bales and productivity of 457 kg ha-1 (INDIASTATS 2023-24). Among the several other factors affecting the yield loss of crops, damage by the pest insect is considered one of the major factors causing the sustainable yield loss under field conditions. Cotton was infested by 162 species of arthropod pests during the vegetative and reproductive stages, of which about 12 species are important in India. Generally, cotton insect pests are divided into two categories, i.e., sucking pests and chewing pests (Nadeem *et al*., 2021). The borers are considered the main threat to the cotton crop until the introduction of Bt cotton, but this threat has been shifted to sucking insect pests, especially. Aphids (*Aphis gossypii*; Glover), leafhoppers (*Amrasca biguttula biguttula*; Ishida), thrips (*Thrips tabaci*; Linn), and whiteflies (*Bemisia tabaci*) are among the sap feeders that seriously harm crops. The estimated monetary value of crop losses resulting from insect pests was Rs. 33,966 crores (Srivastava & Dhaliwal, 2010). Among sucking pest thrips alone reduce cotton output by 39–50 per cent (Kranthi, 2008; Bhat *et al.*, 1984). Among these sucking pests, the increased incidence of thrips has been noted in recent years. A minor pest, *Thrips tabaci* Lindeman, has become a serious pest on Bt cotton in India (Sarode *et al.* 2009). Thrips are generally one of the main early-season cotton pests. Thrips initially damage the cotyledons and then several other parts, including the bolls, and the types of damage vary according to the parts of the plant attacked. Both adults and nymphs usually remain on the under surface of leaves, lacerate the tissues, and suck the cell sap. The affected leaves become thickened, blistered, and bronzed due to continuous feeding (Kirk, 1995). In extreme cases, around 30-50 percent of lint yield loss has been reported (Cook *et al.,* 2011). Losses caused by thrips to various agricultural and horticultural crops during the past decade have resulted in huge economic losses. Several species of thrips are known to infest cotton. In addition to directly harming the crop, they can also act as important vectors of viral diseases. Cotton mosaic disease caused by Tobacco Streak Virus (TSV) is causing concern to the cotton farmers. TSV was reported to be transmitted by different thrips species in various crops (Cook *et al.,* 2003). Thrips have been successfully managed using a number of conventional insecticides. There are a lot of opportunities to handle different pests by applying newer compounds from new pesticide groups with distinct modes of action. The majority of modern pesticides are less persistent, have great target specificity, pose little risk to non-target creatures, and are ecologically safe.

**Materials and methods:**

Field trials were conducted during *kharif*, 2024, at Siddhapur farm of RARS, Warangal, to evaluate the efficacy of newer insecticides for the management of thrips. The experiment was laid out in a randomized block design with seven treatments, including the untreated control, and replicated thrice. The plot size was 5m X 5m with a spacing of 90cm between the rows and 15cm between plants. The hybrid RCH 971 was selected for study, and sowing was done on 30th July 2024. All the recommended agronomic package of practices were adopted in managing the crop to maintain a good crop stand. The insecticides were applied according to the recommended dose prescribed on the label, and they were applied when the pest population crossed the economic threshold level. The insecticides with novel mode of action, *viz.,* Isocycloseram 9.2% DC, Cyantriniprole 10.6% OD, Chlorfenapyr 240 SC, Flonicamid 50 WG, Tolfenpyrad 15% EC, and Fipronil 5% SC, were tested for their efficacy. The data on the population of thrips was recorded from randomly selected 3 leaves (1 upper, 1 medium, 1 lower) from randomly selected five plants per plot and replication-wise at pre-treatment and 1,3,5,7, and 10 days after the first and second application. The data that we obtained was then analysed per cent reduction of thrips population over control was analysed by using standard statistical methods, and the effect of treatments on thrips was recorded.

**Results and discussion**

Data on thrips population after first insecticidal spray, treatment Fipronil 5% SC (13.40) recorded lowest population followed by Isocycloseram 9.2% DC (13.50), Flonicamid 50 WG (14.90), Cyantriniprole 10.6%OD (15.60), Chlorfenapyr 240 SC (16.10), Tolfenpyrad 15% EC (16.20) and all these treatments are on par with each other in reducing the thrips population and significantly differ from untreated control (18.23) at 1 day after spray. After 3DAS Isocycloseram 9.2% DC recorded the best treatment to control thrips population, and this treatment was on par with Fipronil 5% SC (8.63), Flonicamid 50 WG (8.80), Chlorfenapyr 240 SC (9.20), Cyantriniprole 10.6%OD (10.16) treatments. The next best treatments were Tolfenpyrad 15% EC (11.17), and all the insecticidal treatments were significantly different from the untreated control (18.67) in controlling the thrips population. At 5 DAS, the results showed that the treatment Fipronil 5% SC (5.20), followed by Isocycloseram 9.2% DC (5.45), Cyantriniprole 10.6%OD (7.03), and these insecticide treatments were on par with each other in controlling the thrips population. The next best treatments were Flonicamid 50 WG (7.90), Chlorfenapyr 240 SC (8.37), and Tolfenpyrad 15% EC (9.13) and these treatments were on par with each other, and at Das same trend was noticed in controlling the thrips population. The data recorded on 10 days after the first spray of Isocycloseram 9.2% DC (2.76) was the superior treatment, followed by Fipronil 5% SC (3.87), and these treatments were on par with each other. The next best treatments are Flonicamid 50 WG (3.87) and Cyantriniprole 10.6% OD (4.87). The other treatments, Chlorfenapyr 240 SC (6.60) and Tolfenpyrad 15% EC (7.53), were best and significantly differed from the untreated control (15.03) in controlling the thrips population. Regarding the percentage reduction of thrips population over the untreated control was highest in Isocycloseram 9.2% DC (81.5) treatment. The remaining insecticidal treatments Cyantriniprole 10.6%OD, Chlorfenapyr 240 SC, Flonicamid 50 WG, Tolfenpyrad 15% EC, and Fipronil 5% SC were recorded as 67.6, 56.1, 68.7, 49.9, and 74.2 per cent reduction of thrips population over the untreated control.

After second insecticidal spray, the data revealed that, Flonicamid 50 WG treated plants showed lowest thrips incidence (4.96), followed by Isocycloseram 9.2% DC (5.06), Fipronil 5% SC(5.40), Cyantriniprole 10.6%OD (6.06) and Chlorfenapyr 240 SC (6.80) treatments and these treatments were on par with each other in controlling thrips population at 1 DAS. All the insecticidal treatments were significantly different from the untreated control (14.33). The observations recorded on 3DAS showed that Isocycloseram 9.2% DC (3.70) was superior treatment, followed by Fipronil 5% SC (5.03) and Flonicamid 50 WG (5.86). A similar trend was noticed at 5 and 7 days after spray. The data 10 DAS showed that Isocycloseram 9.2% DC (1.33) was a superior treatment followed by followed by Fipronil 5% SC (2.23), Flonicamid 50 WG (2.73), and these insecticidal treatments were on par with each other. The next best treatments are Cyantriniprole 10.6%OD (3.43), Chlorfenapyr 240 SC(4.10), and Tolfenpyrad 15% EC (5.36). All the insecticidal treatments were significantly differ from the untreated control (11.36) in controlling the thrips population in cotton. Regarding the percentage reduction of thrips population in different insecticidal treatments over the untreated control was highest in Isocycloseram 9.2% DC (88.3) treatment. The remaining insecticidal treatments, Cyantriniprole 10.6%OD, Chlorfenapyr 240 SC, Flonicamid 50 WG, Tolfenpyrad 15% EC, and Fipronil 5% SC, were recorded as 69.8, 63.9, 75.9, 52.7, and 80.3 per cent reduction of thrips population over the untreated control. The efficacy of different insecticidal treatments against per cent reduction of thrips population over the untreated control after the second spray was found to be in the following order.

T1>T6>T4>T2>T3>T5>T7

The present findings are in accordance with Bryant (2024), who reported that Isocycloseram 9.2% DC significantly reduced the thrips population when compared to other insecticidal treatments in cotton. Similarly, Isocycloseram 9.2% DC was more effective in suppressing the highly infested onion thrips (Pin and Brian, 2023; John, 2022). It is due to having the plinazolin technology with a novel mode of action. The present investigation was also in agreement with Rajashekar*et al*. (2018), who reported that Fipronil 5% SC was one of the best studied pesticides in High Density Planting System and conventional spacing, and was proven to be best in thrips population reduction. Similarly, Sathyan *et al*. (2016) reported that Fipronil 5 SC dramatically decreased the thrips population by 83.06 per cent mean reduction over control. Present results were also in agreement with Kumar *et al.* (2012) and Patil *et al*. (2009), who reported that Fipronil 5% SC was very effective in controlling thrips population. The present findings were corroborated by the findings of Meghana *et al.* (2018), who reported that Flonicamid 50 WG was effective in reducing the thrips population compared to other treatments. Similarly, China Babu *et al*. (2017) reported that the Flonicamid 50 WG@ 0.3g L-1 was the most effective in suppressing population of thrips. These results were also in conformity with Srivastava *et al*.(2014), who reported that selective insecticides *viz.,* Flonicamid 50 WG and Cyantriniprole 10.6%OD offered moderate impact against thrips in vegetables and making them suitable for Integrated Pest Management.

The results revealed that all the insecticidal treatments recorded significantly higher cotton yield over the untreated control (1263 kg ha-1). Among all the insecticidal Isocycloseram 9.2% DC recorded a higher yield (2004 kg ha-1), followed by Fipronil 5% SC (1820 kg ha-1), Flonicamid 50 WG (1750kg ha-1), and Cyantriniprole 10.6%OD (174kg ha-1), and these treatments were on par with each other. The other treatments, Chlorfenapyr 240 SC and Tolfenpyrad 15% EC, recorded 1516 kg ha-1 and 1496 kg ha-1 Seed cotton yield, respectively. Regarding the benefit cost ratio of different treatments, maximum benefit was from Fipronil 5% SC recorded the highest benefit cost ratio of 5.90:1, followed by Flonicamid 50 WG (5.56:1), Isocycloseram 9.2% DC(4.46:1), Chlorfenapyr 240 SC (3.25:1), Cyantriniprole 10.6%OD (2.05:1), and the least was 1.76:1 in Tolfenpyrad 15% EC.

These results are by Patil *et al*. (2009), who reported that fipronil 5 % SC @ 800g ha-1 registered the least number of thrips (8.47/3 leaves) in cotton with seed cotton yield 27.23 q ha-1 in 2007, 27.50 q ha-1 in 2008, respectively, compared to other treatments. Similarly, Radhika *et al.* (2018), who reported fipronil 5SC spray @ 50 g a.i ha-1 can at weekly intervals against sucking pests in blackgram, saved 269 kg ha-1 pod yield with an avoidable yield loss of 26.16 per cent. These results were also in conformity with Shivaramakrishna and Rama Reddy (2020), who reported that flonicamid was a newer insecticide and effectively controls the sucking pests and helps in increased yield of cotton.

**Conclusion:**

In the present investigation, treatment with Isocycloseram 9.2% DC and Fipronil 5% SC, and Flonicamid 50 WGwere found more effective against thrips infesting cotton. These insecticides can be recommended for the management of thrips on cotton HDPS considering their effectiveness, economics, and increasing its cotton seed production.

**CONCLUSION SEEMS TO BE INCOMPLETE**

**Conflict of interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**COMPETING INTERESTS DISCLAIMER:**

**Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.**

**Table 1: Efficacy of insecticides against cotton thrips, *Thripstabaci,* after the first spray during *kharif*, 2024**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatments** | **Dosage**  **(g or ml l-1)** | **Thrips population ( No./3leaves)** | | | | | | **Per cent population reduction over control** |
| **Pre count**  **(DBS)** | **1 DAS** | **3 DAS** | **5 DAS** | **7 DAS** | **10 DAS** |
| T1:Isocycloseram9.2% DC | 1.2 ml | 18.47  (4.40) | 13.50  (3.80)a | 7.93  (2.98)a | 5.45  (2.53)a | 3.63  (2.14)a | 2.76  (1.92)a | 81.6 |
| T2:Cyantriniprole 10.6%OD | 1.4 ml | 22.27  (4.82) | 15.60  (4.06)ab | 10.16  (3.33)ab | 7.03  (2.83)ab | 6.93  (2.81)bc | 4.87  (2.41)bc | 67.6 |
| T3:Chlorfenapyr 240% SC | 0.85 ml | 20.60  (4.64) | 16.10  (4.13)ab | 9.20  (3.19)ab | 8.37  (3.06)b | 7.40  (2.89)bc | 6.60  (2.75)cd | 56.1 |
| T4:Flonicamid 50% WG | 0.3 g | 19.00  (4.47) | 14.90  (3.98)ab | 8.80  (3.12)ab | 7.90  (2.96)b | 5.93  (2.63)b | 4.70  (2.38)bc | 68.7 |
| T5:Tolfenpyrad 15% EC | 2 ml | 20.57  (4.64) | 16.20  (4.14)ab | 11.17  (3.47)b | 9.13  (3.17)b | 7.90  (2.97)c | 7.53  (2.91)d | 49.9 |
| T6:Fipronil 5% SC | 2 ml | 19.47  (4.51) | 13.40  (3.79)a | 8.63  (3.09)a | 5.20  (2.48)a | 3.60  (2.13)a | 3.87  (2.18)ab | 74.2 |
| T7:Untreated control | - | 18.23  (4.38) | 18.30  (4.38)b | 18.67  (4.43)c | 18.13  (4.37)c | 15.33  (4.03)c | 15.03  (4.004)e | - |
| SEm(±) |  | 0.13 | 0.11 | 0.11 | 0.12 | 0.10 | 0.12 | - |
| CD (p=0.05) |  | NS | 0.37 | 0.35 | 0.38 | 0.32 | 0.40 | - |
| CV(%) |  | 5.11 | 5.10 | 5.78 | 7.05 | 6.36 | 8.44 | - |

Note: Figures in parentheses are square root transformed values; **DBS-** Day Before Spray; **DAS**- Day After Spray**; NS**- Non-Significant

**Table 2: Efficacy of insecticides against cotton thrips, *Thripstabaci,* after the second spray during *kharif*, 2024**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatments** | **Dosage**  **(g or ml l-1)** | **Thrips population ( No./3leaves)** | | | | | | **Per cent population reduction over control** |
| **Pre count**  **(DBS)** | **1 DAS** | **3 DAS** | **5 DAS** | **7 DAS** | **10 DAS** |
| T1:Isocycloseram9.2% DC | 1.2 ml | 6.26  (2.68)ab | 5.06  (2.46)a | 3.70  (2.16)a | 3.30  (2.06)a | 2.16  (1.77)a | 1.33  (1.63)a | 88.3 |
| T2:Cyantriniprole 10.6%OD | 1.4 ml | 7.37  (2.88)ab | 6.06  (2.64)a | 6.50  (2.73)b | 4.90  (2.42)ab | 3.23  (2.05)ab | 3.43  (2.08)bc | 69.8 |
| Chlorfenapyr 240% SC | 0.85 ml | 7.96  (2.98)ab | 6.80  (2.79)ab | 6.36  (2.69)b | 5.33  (2.50)ab | 3.73  (2.17)ab | 4.10  (2.24)bc | 63.9 |
| T4:Flonicamid 50% WG | 0.3 g | 6.33  (2.69)ab | 4.96  (2.44)a | 5.86  (2.61)ab | 3.73  (2.15)a | 2.96  (1.98)ab | 2.73  (1.93)ab | 75.9 |
| T5:Tolfenpyrad 15% EC | 2 ml | 8.83  (3.11)b | 7.90  (2.98)b | 7.03  (2.83)b | 6.83  (2.78)b | 5.20  (2.45)b | 5.36  (2.52)c | 52.7 |
| T6:Fipronil 5% SC | 2 ml | 5.50  (2.54)a | 5.40  (2.52)a | 5.03  (2.44)ab | 3.93  (2.21)a | 2.66  (1.90)a | 2.23  (1.73)a | 80.3 |
| T7:Untreated control | - | 14.70  (3.96)c | 14.33  (3.91)c | 14.70  (3.95)c | 13.73  (3.83)c | 12.33  (3.65)c | 11.36  (3.45)d | - |
| SEm(±) |  | 0.16 | 0.10 | 0.14 | 0.15 | 0.16 | 0.08 | - |
| CD (p=0.05) |  | 0.50 | 0.32 | 0.44 | 0.48 | 0.50 | 0.24 | - |
| CV(%) |  | 9.41 | 6.31 | 8.98 | 10.57 | 12.38 | 6.11 | - |

Note: Figures in parentheses are square root transformed values; **DBS-** Day Before Spray; **DAS**- Day After Spray

**Table 3: Effect of different insecticides on cotton yield and incremental benefit cost ratio analysis for insecticidal treatments against *Thrips tabaci* during *kharif* 2024**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Treatments** | **Seed cotton yield**  **(Kg ha-1)** | **Increased yield over control**  **(Kg ha-1)** | **Cost of treatment**  **(Insecticide cost + Labour cost)**  **(Rs. ha-1)** | **Profit of additional yield**  **(Rs. 7010 per quintal)** | **Net profit**  **(Rs ha-1)** | **B: C ratio** |
| Isocycloseram 9.2% DC | 2004 | 741 | 9492 | 51870 | 42378 | 4.46:1 |
| T2:Cyantriniprole 10.6%OD | 1714 | 451 | 10361 | 31570 | 21209 | 2.05:1 |
| T3:Chlorfenapyr 240% SC | 1516 | 253 | 4163 | 17710 | 13547 | 3.25:1 |
| T4:Flonicamid 50% WG | 1750 | 487 | 5200 | 34139 | 28939 | 5.56:1 |
| T5:Tolfenpyrad 15% EC | 1496 | 233 | 5976 | 16310 | 10334 | 1.76:1 |
| T6:Fipronil 5% SC | 1820 | 557 | 5650 | 38990 | 33340 | 5.90:1 |
| T7: Untreated control | 1263 | - | - | - | - | - |

**References:**

Agale, D. A., Yadav, G. A., Bhosle, B. B. and Bhede, B.V., 2010. Bioefficacy and economics of insecticides against thrips (Scritothripsdorsalis Hood) on Bt cotton. *Indian Journal of Entomology*, *72*(1), pp.29-32.

Aslam, M., Razaq, M., Shah, S.A. and Ahmad, F., 2004.Comparative efficacy of different insecticides against sucking pests of cotton. *Journal of Scientific Research 15*(1), pp.53-58.

Bharpoda, T.M., Patel, N.B., Thumar, R.K., Bhatt, N.A., Ghetiya, L.V., Patel, H.C. and Borad, P.K., 2014. Evaluation of insecticides against sucking insect pests infesting Bt cotton BG-II. *The bioscan*, *9*(3), pp.977-980.

Bhat, M.G., Joshi, A.B and Munshi Singh. 1984. Relative loss of seed cotton yield by sucking pests and bollworms in some cotton genotypes (*Gossypiumhirsutum* L.). *Indian Journal of Entomology*. 42: 130-132.

Broughton, S. and Herron, G.A., 2009. Potential new insecticides for the control of western flower thrips (Thysanoptera: Thripidae) on sweet pepper, tomato, and lettuce. *Journal of Economic Entomology*, *102*(2), pp.646-651.

Bryant, T. and Malone, S., 2025.Efficacy of selected foliar insecticides against thrips in cotton, 2024. *Arthropod Management Tests*, *50*(1), p.tsaf022.

Cook, D., Herbert, A., Akin, D.S. and Reed, J., 2011. Biology, crop injury, and management of thrips (Thysanoptera: Thripidae) infesting cotton seedlings in the United States. *Journal of Integrated Pest Management*, *2*(2), pp.B1-B9.

Cook, D.R., Allen, C.T., Burris, E. Freeman, B. L., Gary B.L., Herzog, A., Lentz, G.L., Leonard, B.R and Reed, J.T. 2003. A Survey of Thrips (Thysanoptera) Species Infesting Cotton Seedlings in Alabama, Arkansas, Georgia, Louisiana, Mississippi, and Tennessee.*Journal Entomological Science*. 38(4): 669-681.

Kirk, W.D., 1995. Feeding behavior and nutritional requirements.In *Thrips biology and management* (pp. 21-29). Boston, MA: Springer US.

Kranthi, K.R. 2008. Insecticide resistance management in cotton to enhance productivity, Model training course on cultivation of long staple cotton, Central Institute for Cotton Research, Regional station, Coimbatore, December 15-22, pp. 214-231.

Kumar, R., Kranthi, S., Nitharwal, M., Jat, S.L. and Monga, D., 2012. Influence of pesticides and application methods on pest and predatory arthropods associated with cotton. *Phytoparasitica*, *40*, pp.417-424.

Lai, P.C. and Nault, B.A., 2023. Managing a high infestation of onion thrips in onion with insecticides, 2023. *Arthropod Management Tests*, *48*(1), p.tsad119.

Mayee, C.D., Gautam, H.C and Barik, A. 2004.Cotton scenario in India vis-a-vis world and future need. In: Recent Advances in Cotton Research and Development. Haryana Agricultural University and Cotton Research and Development Association, CCSHAU, Hisar. PP 245 – 253.Panickar, B.K and Patel, J.R. 2001.Population dynamics of different species of thrips on chilli, cotton and pigeon pea.*Indian Journal of Entomology.*63(2): 170.

Meghana, H., Jagginavar, S.B. and Sunitha, N.D., 2018. Efficacy of insecticides and bio pesticides against sucking insect pests on Bt cotton. *International Journal of Current Microbiology and Applied Sciences*, *7*(06), pp.2872-2883.

Nadeem, A., Tahir, H.M. and Khan, A.A., 2021. Plant age, crop stage and surrounding habitats: their impact on sucking pests and predators complex in cotton (*Gossypiumhirsutum* L.) field plots in arid climate at district Layyah, Punjab, Pakistan. *Brazilian Journal of Biology*, *82*, p.e236494.

Naik, V.C.B., Kranthi, S. and Viswakarma, R., 2017. Impact of newer pesticides and botanicals on sucking pest management in cotton under high density planting system (HDPS) in India. *Journal of Entomology and Zoology Studies*, *5*(6), pp.1083-1087.

Palumbo, J.C., 2022. Western flower thrips control with isocycloseram on romaine lettuce, spring 2021. *Arthropod Management Tests*, *47*(1), p.tsac037.

Patil S B, Udikeri S S, Matti P V, Guruprasad G S, Hirekurubar R B, Saila H M, Vandal N B. 2009. Bioefficacy of new molecule fipronil 5%SC against sucking pest complex in Bt cotton. Karnataka Journal of Agricultural Sciences 22(5): 1029-1031.

Radhika, M., Reddy, N.C., Anitha, V., Vidhyasagar, B. and Ramesh, S., 2018. Efficacy of insecticides against sucking pest complex in blackgram. *International Journal of Chemical Studies*, *6*(5), pp.1793-1797.

Rajasekhar, N., Prasad, N.V.V.S., Kumar, D.V. and Adinarayana, M., 2018. Incidence and management of cotton thrips (Thripstabaci) in high density planting system (HDPS) under rain fed conditions. *Journal of Entomological Research*, *42*(3), pp.373-376.

Sarode, S.V., Kolhe, A.V. and Sable, V.R. (2009) IPM strategies for cotton in relation to climate change. In: V.V. Ramamurthy, G.P. Gupta and S.N. Puri (eds) Proc. Natn. Symp. IPM Strategies to Combat Emerging Pests in the Current Scenario of Climate Change. January 28-30, 2009, Pasighat, Arunachal Pradesh, pp.181-205.

Sathyan, T., Murugesan, N., Elanchezhyan, K., Raj, A.S. and Ravi, G., 2016.Efficacy of Synthetic Insecticides against sucking insect pests in cotton, Gossypiumhirsutum L. *International Journal of Entomological Research*, *1*(1), pp.16-21.

Shah, Z.H., Sahito, H.A., Kousar, T., Rind, M.M., Jatoi, F.A. and Mangrio, W.M., 2017.Integrated pest management of cotton thrips, Thripstabaci (Lindeman, 1889) through selected pesticides under vitro conditions. *International Journal of Research Studies Zoology*, *3*(4), pp.76-83.

Srivastava, K.P and Dhaliwal, G.S. 2010, A text book of applied entomology. In: Kalyani publishers, New Delhi, India, pp. 35-41.

Srivastava, M., Funderburk, J., Olson, S., Demirozer, O. and Reitz, S., 2014. Impacts on natural enemies and competitor thrips of insecticides against the western flower thrips (Thysanoptera: Thripidae) in fruiting vegetables. *Florida Entomologist*, pp.337-348

ThripsWiki (2021) ThripsWiki - providing information on the World's thrips. Available from: http://thrips.info/wiki/Main\_Page [accessed 15 August 2021].

Udikeri, S.S., Patil, S.B., Hirekurubar, R.B., Guruprasad, G.S., Shaila, H.M. and Matti, P.V., 2010. Management of sucking pests in cotton with new insecticides. *Karnataka Journal of Agricultural Sciences*, *22*(4).

Vanisree, K., Upendhar, S., Rajasekhar, P. and Rao, G.R., 2017. Relative resistance of different insecticides on chilli thrips, Scirtothripsdorsalis (Hood) in Andhra Pradesh. *International Journal of Economic Plants*, *4*(2), pp.66-69.