International Journal of Chemical Studies

**P-ISSN: 2349–8528**
**E-ISSN: 2321–4902**
IJCS 2019; 7(6): 1826-1829

Received: 05-09-2019
Accepted: 06-10-2019

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# Effect of various modules against Aphid, *Aphis gossypii* (Glover) on Okra

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**Abstract**
Field studies were undertaken on "Evaluation of various modules against major pests of okra" during summer 2014-15 and *Kharif* 2015-16 on the field of Chilli and Vegetable Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS.). An experiment was laid in randomized block design consisting of eight modules viz., M1 (fully organic), M2, M3 and M4 (Chemical module with sequential use of insecticides), M5, M6 and M7 (IPM based module having ST, Soil application, YST and sequential use of chemical insecticides) and untreated module M8 to find out effective modules against aphid on okra. The results revealed that module M7 (ST, SA, YST, Cyper+Dim., Fenpo, Ethion+Quin and Lamb.) was found statistically superior over all other treatments in recording the lowest aphid population (3.57/leaf) and significantly most effective in minimizing the population of aphids at 3,7 and 14 days after spraying. Next effective modules M5, M6 and M3 in second order of merit were found statistically equal among themselves. Module M2 was found least effective in minimizing the aphid population.

**Keywords:** Okra, aphid, modules, seed treatment. soil application, YST

## Introduction
Okra (*Abelmoschus. esculentus* L. Monech) or *Bhindi* is an important vegetable crop due to its nutritional value. It is good source of vitamin A, B, C and is also rich in protein, minerals and iodine (Baloch *et al*., 1990) [3]. Among the commercially cultivated vegetable crops in India, okra [*Abelmoschus esculentus* (L.) Moench] ranked sixth in terms of area and production with country contributing about 73.25 per cent to the world's total production (Anon., 2013) [1]. The continuous growth is congenial for the infestation of insect pests and it is one of the major limiting factors in the profitable cultivation of the crop (Ashok Kumar, *et al.,* 2009) [2]. Many insect pests incidence were recorded from sowing upto harvest on bhendi plants in India and listed the most destructive insect pests as leafhopper, *Amrasca biguttula biguttula* (Ishida), aphid, *Aphis gossypii* (Glover), whiteflies, *Bemisia tabaci* (Gennadius), fruit borer, *Helicoverpa armigera* (Hubn.), spotted bollworm, *Earias vittella* (Fabricius) and *Earias insulana* (Boisd.) (Mane, *et al.,* 2010) [8]. Among these aphids, *Aphis gossypii* is a polyphagous sucking pest and also found damaging okra all over India. It also acts as vector of virus and transmits mosaic, leaf curl tec. (Butani and Verma, 1976) [6]. The demand of vegetables like Okra increases day by day. Being short duration and high yielding, growers get more profit per unit area. However, various problems are faced by cultivators at the time when incidence of sucking pests observed in initial stages on Okra crop. Boosting of its production is of prime importance and considerable. To tackle this sucking pest menace, a number of chemical insecticides are liberally sprayed on this vegetable crop, which led to several problems like toxic residues, elimination of natural enemies, environmental disharmony and development of resistance. Due to the presence of pesticidal residues in the final commodity, there is a risk of rejection of whole consignments during export. Investigations were carried out in order to find out suitable, effective, ecofriendly and economical plant protection measures against major sucking pests of Okra with the objectives. To find out effective module against aphid.

## Material and Method
Evaluation of various modules against aphid on okra. The trials were conducted during summer *2014-15* and *Kharif 2015-16* at Chilli and Vegetable, Research Unit, Dr. PDKV., Akola. Okra variety Akola bahar sown in well prepared land and the crop was grown following all standard package of practices. The experiments were laid in Randomized Block Design (RBD) with three replications and eight modules.

The crop was sown at a spacing of 45 cm x 30 cm and 60 cm x 45cm with gross plot size of 4.95m x 3 m. and 5.1mx3.0m. Treatment schedule was as follows.

| | Treatments details |
|---|---|
| **M1** | • Soil application of neem cake @250kg/ha at time of sowing |
| | • Installation of yellow sticky trap at 15 DAS (30x15cm size of foam sheet) at 2 opposite corner along crop canopy and 15 cm above crop canopy |
| | • Weekly clipping of infested shoots from the appearance of pests. |
| | • Foliar application of azadirachtin 1% w/w @5ml/L at 15 days interval from sowing to 75 days after sowing. |
| **M2** | • Seed treatment with Imidacloprid 48 FS @ 9ml/kg seed |
| | • Dimethoate 30EC @ 2ml/L at 30 DAS followed by. |
| | • Quinalphos 25 EC @ 2ml/L at 45 DAS followed by |
| | • Fenpropathrin 30 EC @ 0.35ml/L at 60 DAS followed by. |
| | • Dicofol 18.5 EC @ 2.7ml/L+Quinalphos 25 EC @ 2ml/L at 75 DAS. |
| **M3** | • Installation of yellow sticky trap at 15 DAS (30x15cm size of foam sheet) at 2 opposite corner along crop canopy and 15 cm above crop canopy |
| | • Acephate 75 SP @ 1.6g/L at 15 DAS followed by. |
| | • Quinalphos20 EC @ 2ml/L at 30 DAS followed by |
| | • Fenpropathrin 30 EC @ 0.35ml/L at 45 DAS followed by |
| | • Spiromesifen 22.9 SC @1ml/L + Lambda |
| | • cyhalothrin 5 EC @1ml/L at 60 DAS followed by |
| | • Fenvalerate 20 EC @ 1ml/L at 75 DAS. |
| **M4** | • Triazophos 40 EC @ 2ml/L at 15 DAS followed by |
| | • Fenvalerate 20EC @ 1ml/L at 30 DAS followed by |
| | • Quinalphos 25 EC @ 2ml/L+ Spiromesifen 22.9 SC @1ml/Lat 45 DAS followed by |
| | • Fenpropathrin 30 EC @ 0.35 ml/L at 60 DAS followed by |
| | • Lambda cyhalothrin 5 EC @1ml/L at 75 DAS. |
| **M5** | • Soil application of neem cake @250kg/ha at time of sowing |
| | • Installation of yellow sticky trap at 15 DAS (30x15cm size of foam sheet) at 2 opposite corner along crop canopy and 15 cm above crop canopy |
| | • Thiamethoxam 25 WG @ 0.2g/L at 30 DAS followed by |
| | • Fenpropathrin 30 EC @ 0.35ml/L at 45 DAS followed by |
| | • Lambda cyhalothrin 5 EC @1ml/L at 60 DAS followed by |
| | • Triazophos 40 EC @ 2ml/L + Dicofol 18.5 EC @ 2.7ml/L at 75 DAS. |
| **M6** | • Seed treatment with imidacloprid 48 FS @ 9ml/kg seed |
| | • Soil application neem cake @250kg/ha at time of sowing |
| | • Installation of yellow sticky trap at 15 DAS (30x15cm size of foam sheet) at 2 opposite corner along crop canopy and 15 cm above crop canopy |
| | • Cypermethrin 25 EC @ 0.4ml at 30 DAS followed by |
| | • Triazophos 40 EC @ 2ml/L at 45 DAS followed by |
| | • Fenpropathrin 30 EC @ 0.35ml/L at 60 DAS followed by |
| | • Acephate 75 SP @ 1.6g/L+ Spiromesifen 22.9 SC @1ml/Lat 75 DAS. |
| **M7** | • Seed treatment with imidacloprid 48 FS @ 9ml/kg seed |
| | • Soil application neem cake @250kg/ha at time of sowing |
| | • Installation of yellow sticky trap at 15 DAS (30x15cm size of foam sheet) at 2 opposite corner along crop canopy and 15 cm above crop canopy |
| | • Cypermethrin 25 EC @ 0.4ml + Dimethoate 30EC @ 2ml/L at 30 DAS followed by |
| | • Fenpropathrin 30EC @ 0.35ml/L at 45 DAS followed by |
| | • Ethion 50 EC @ 2.5ml/L + Quinalphos 25 EC @ 2ml/L at 60 DAS followed by |
| | • Lambda cyhalothrin 5 EC @1ml/L at 75 DAS |
| **M8** | • Untreated control |

The experiment was conducted in RBD with eight modules replicated thrice. Pre-treatment observation were taken 24 hrs before spray and post treatment observation were recorded at 3, 7 and 14 days after each spraying on randomly selected 5 plants per plot. For observation on aphid, was recorded on 3 leaves (top, middle and bottom canopy of the plant) per plant at 3, 7 and 14 DAS on five randomly selected plants per plot after each spraying. Data so obtained during summer *2014-15 and kharif 2015-16* were statistically analysed after suitable transformation and the inferences were drawn basing on the results.

## Results and Discussion

The data presented in Table 1 showed that pooled mean data on the incidence of aphid 24 hours before first spray were found statistically non-significant during summer *2014-15 and kharif 2015-16.* However, incidence of aphids in various treatments was found in the range of 3.01 aphids/leaf in module M7 to 4.61 aphids/leaf in module M8.

### Aphid population at 3 days after spray

During summer 2014-15 at 3 days after spray was found to be statistically significant. The treatment module M7 was found significantly superior over, M4, M2 and M8 modules in recording minimum incidence of aphids (1.93/leaf) and was statistically at par with M5 (2.11/leaf), M6(2.21/leaf), M3 (2.52/leaf) and M1 module (2.76/leaf). Second best effective modules M5 was found statistically at par with M6, M3, M1

and M4 (2.87/leaf) and superior over rest of the treatments. However, module M2 (3.70/leaf/aphids) was found in effective which was statistically at par with module M4 and module M1.Maximum incidence of 8.29 aphids/leaf was recorded in module M8 i.e. (Unprotected control). During kharif 2015-16 the lowest population of aphids was recorded in treated module M7 (2.90/leaf) followed by M5 (4.03/leaf) and M3 (4.26/leaf) and these treatments were found to have statistically similar effect. Of these, the module M7 was found to be significantly superior over the remaining treated modules and module M5 and M3 although were next promising modules against aphids but they were found to be statistically at par with rest of the treated module viz.M6 (4.38aphids/leaf), M4 (4.78aphids/leaf), M1 (5.01aphids/leaf) and M2 (5.22 aphids/leaf), whereas the maximum aphid population was noticed in untreated control module M8 (12.40 aphids/ leaf). Pooled mean data the minimum aphid population was observed in module M7 (2.41/leaf) followed by M5 (3.07/leaf) and both the treatments were found statistically at par with each other. The module M5 was found further statistically at par with module M6 (3.30/leaf) and module M3 (3.39/leaf). The module M6 which were found to be statistically at par with module M4 (3.83/leaf) and module M1 (3.89/leaf). The module M2 had accounted the aphid population to the tune of 4.46/leaf and it had exerted the statistically similar effect to that of module M1 and M4. The unprotected control M8 observed the highest population of aphids (10.34/leaf).

**Aphid population at 7 days after spray**

During summer 2014-15 at 7 days after spray was found to be statistically significant. The Module M7 (2.42 aphid/leaf) was found statistically at par with M5 (2.81 aphids/leaf) and module M6 (3.32 aphids/leaf) in recording minimum incidence of aphids (2.42 aphids/leaf) and superior over all other remaining treatments. Second best effective module M5 was found statistically at par with M6 and M3 (3.84aphids/leaf) and superior over rest of the treatments except module M7. Next effective module in order of merit M6 was found statistically at par with M3 (3.84aphids/leaf), M1 (4.03 aphids/leaf) and M4 (4.18 aphids/leaf) and superior over M2 and M8. Module M2 was found least effective in recording comparatively minimum incidence of (5.22 aphids/leaf) which in turn was found statistically at par with module M4 and M1. Maximum incidence of aphids 8.83 aphids/leaf was recorded in module M8 (Untreated control). During kharif 2015-16 lowest aphid population was recorded in module M7 (3.91/leaf) and it was followed by M5 (4.74/leaf) and both the treatments were found to be statistically similar effective. The treated module M5 was observed to be further at par with M3 (5.40 aphids/leaf), M6, (5.48aphids/leaf), M4, (6.22aphids/leaf), M2 (6.29 aphids /leaf). The M1 had noticed aphid population to the tune of 6.40/leaf and it has shown equal effect to those of M3, M6, M4 and M2. The module M8 had shown the maximum incidence of aphids (13.24/leaf). From pooled mean it was seen that the module M7 had registered the lowest aphid population (3.17/leaf) followed by the module M5 (3.77/leaf/aphid) and both the modules were statistically at par with each other and superior over rest of the modules. However module M5 was further statistically similar with M6 (4.40/aphids/leaf).The module M3 noticed aphid population of (4.62/leaf) showing statistically similar effectiveness to that of module M6 and superior over M4, M1, M2 and M8. Further it remained statistically at par with M4 (5.20), M1 (5.21) which were found further statistically at par with module M2 (5.75/aphids/leaf).The module M8 had shown the maximum incidence of aphids (11.03/leaf).

**Aphid population at 14 days after spray**

During summer 2014-15 at 14 days after spray was found to be significant. The Module M7 was found significantly superior over module M2 and M8 in recording minimum incidence of aphids (4.67/leaf) and it was statistically at par with M5 (4.86 aphids/leaf), M6 (5.31 aphids/leaf) M1(5.90aphids/leaf) and M3 (5.83aphids/leaf) and M4 (6.17 aphid/leaf). Second best modules M1&M3 were found statistically at par with module M4 (6.17aphids/leaf) & M2 (7.17aphids/leaf). Maximum incidence of 9.23 aphid/leaf was recorded in module M8 which in turn was statistically at par with module M2 (7.17 aphids/leaf). During kharif 2015-16 the module M7 had accounted the lowest population of aphids (5.58/leaf). It was followed by M5 (6.46 aphids/leaf), M3 (6.66 aphids/leaf) and M6 (6.88 aphids/leaf) and these four module were found to be statistically at par with each other. The treated module M1, M2 and M4 exhibited aphid population to the tune of 7.63 7.64 and 7.70 aphids/leaf respectively and they were found to be statistically at par M5, M3 and M6 However, the module M8 noticed the maximum incidence population of aphids (14.87/leaf). From the pooled mean data least population of aphid was recorded in module M7 (4.29/leaf), and it was found statistically at par with module M5(4.86/leaf), M6(5.25/leaf) and M3(5.40/leaf).Of these module M5,M6 and M3 were further found to be statistically at par with M1 (5.93/leaf) and M4 (6.05/leaf).The treatment module M2 registered the aphid population to the extent (6.53/leaf) and appeared to be the statistically similar with M6,M3,M1 and M4. The untreated treatment i,e module M8 had recorded the maximum aphid population (11.80/leaf).

**Pooled mean**

From the pooled mean data during *summer* 2014-15 the module M7 (3.01aphid/leaf) was found statistically at par with M5 (3.26 aphids/leaf) and M6 (3.61aphids/leaf) in recording minimum incidence of 3.01 aphids/leaf and superior over all other remaining modules. The same trend was noticed in *kharif* 2015-16 lowest population of aphids was observed in module M7 (4.13/leaf) and it was statistically at par with module M5 (5.08/leaf). From the pooled mean data the treatment module M7 was found statistically superior over all other treatments recording the lowest aphid population (3.57/leaf). The second best module M5 noticed the aphid population to the tune of (4.17/leaf) and it was found statistically at par with module M6 (4.60aphids/leaf) and M3 (4.75aphids/leaf).The module M1, M4 and M2 observed the aphid population of 5.29, 5.32 and 5.87/leaf and remained statistically similar effective with Module M3 whereas, module M8 had recorded the highest population of aphid (11.14/leaf)

It is clear from the above findings that module M7 was found significantly most effective in minimizing the population of aphids at 3, 7 and 14 days after spraying. Next effective modules M5, M6 and M3 in second order of merit were found statistically equal among themselves at 3, 7 and 14 days after spray. The module M2 was found least effective in minimizing the aphid population. It means that the module M7 was significantly most effective followed by module M5, M6 and M3 at 3, 7 and 14 days after spray. Module M2 was found least effective in minimizing the aphid population. Out of the sequential application of treatment in seven modules,

module M7 was found most effective in minimizing the population of aphids during summer 2014-15 and kharif 2015-16 season because this module consists of seed treatment with Imidacloprid 48 FS, @ 9ml /kg,soil application of neem cake @250kg/ha, Yellow sticky trap and sequential application of cypermethrin+ dimethoate, fenpopathrin, ethion+quinalphos and lambda cyhalothrin and were applied to okra at 30,45,60 and 75 days after spraying. Further in this module there is a overall effect of synthetic pyrethoroids + OP compound i.e. cypermethrin 25 EC @ 0.4ml/L + Dimethoate 30EC @ 2ml/L, as synthetic pyrethoids are having quick know down effect and long residual action with systemic, stomach and contact action of dimethoate which played an important role as first application in module M7 to take care of aphids over other modules. Secondly aphid population was generally observed in initial growth stage of the okra crop.

**Table 1:** Effect of various modules on comparative population of aphids on okra during summer 2014-15 and kharif season 2015-16

| T. No. | Treatment details | Pre.-treat. Obs. 24 hrs | 3 DAT | | | 7 DAT | | | 14 DAT | | | | Pooled mean | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Summer | Kharif | Pooled Mean | Summer | Kharif | Pooled Mean | Summer | Kharif | Pooled Mean | Summer | Kharif | Pooled Mean |
| M1 | SA.YST, Azadir achtin 1%w/w | 3.67 (1.75) | 2.76 (1.64) | 5.01 (2.23) | 3.89 (1.94) | 4.03 (2.00) | 6.40 (2.52) | 5.21 (2.28) | 5.90 (2.41) | 7.63 (2.76) | 5.93 (2.59) | 4.23 (2.06) | 6.35 (2.52) | 5.29 (2.29) |
| M2 | ST, Dim, Quin, Fenpo, Dico+Quin. | 3.19 (1.67) | 3.70 (1.91) | 5.22 (2.28) | 4.46 (2.09) | 5.22 (2.29) | 6.29 (2.51) | 5.75 (2.40) | 7.17 (2.67) | 7.64 (2.76) | 6.53 (2.74) | 5.36 (2.33) | 6.38 (2.52) | 5.87 (2.43) |
| M3 | YST, Ace, Quin Fenpo, Spi+Lam, Fenv. | 4.05 (1.87) | 2.52 (1.59) | 4.26 (2.06) | 3.39 (1.83) | 3.84 (1.96) | 5.40 (2.32) | 4.62 (2.14) | 5.83 (2.41) | 6.66 (2.57) | 5.40 (2.49) | 4.06 (2.02) | 5.44 (2.33) | 4.75 (2.17) |
| M4 | Tria, Fenv, Quin+ Spir, Fenpo, Lamb | 3.92 (1.84) | 2.87 (1.69) | 4.78 (2.18) | 3.83 (1.93) | 4.18 (2.04) | 6.22 (2.49) | 5.20 (2.28) | 6.17 (2.48) | 7.70 (2.77) | 6.05 (2.63) | 4.41 (2.10) | 6.23 (2.49) | 5.32 (2.30) |
| M5 | SA, YST, Thia, Fenpo, Lamb, Tria+Dico | 3.61 (1.74) | 2.11 (1.45) | 4.03 (2.00) | 3.07 (1.72) | 2.81 (1.67) | 4.74 (2.18) | 3.77 (1.92) | 4.86 (2.20) | 6.46 (2.53) | 4.86 (2.37) | 3.26 (1.80) | 5.08 (2.25) | 4.17 (2.03) |
| M6 | ST, SA, YST, Cyper, Tria, Fenpo, Ace+Spir | 3.56 (1.59) | 2.21 (1.48) | 4.38 (2.09) | 3.30 (1.78) | 3.32 (1.82) | 5.48 (2.34) | 4.40 (2.08) | 5.31 (2.29) | 6.88 (2.62) | 5.25 (2.46) | 3.61 (1.90) | 5.58 (2.36) | 4.60 (2.13) |
| M7 | ST, SA, YST, Cyper+ Dim., Fenpo, Ethion+Quin, Lamb. | 3.01 (1.62) | 1.93 (1.38) | 2.90 (1.70) | 2.41 (1.54) | 2.42 (1.55) | 3.91 (1.98) | 3.17 (1.76) | 4.67 (2.16) | 5.58 (2.35) | 4.29 (2.25) | 3.01 (1.73) | 4.13 (2.03) | 3.57 (1.88) |
| M8 | Untreated control | 4.61 (1.97) | 8.29 (2.88) | 12.40 (3.51) | 10.34 (3.19) | 8.83 (2.96) | 13.24 (3.62) | 11.03 (3.29) | 9.23 (3.03) | 14.87 (3.85) | 11.80 (3.44) | 8.78 (2.96) | 13.50 (3.66) | 11.14 (3.31) |
| | SE (m)± | 0.19 | 0.09 | 0.12 | 0.07 | 0.10 | 0.10 | 0.07 | 0.12 | 0.12 | 0.09 | 0.06 | 0.09 | 0.05 |
| | CD at 5% | NS | 0.28 | 0.37 | 0.19 | 0.31 | 0.33 | 0.19 | 0.39 | 0.38 | 0.28 | 0.19 | 0.27 | 0.14 |
| | CV% | 26.36 | 9.21 | 9.46 | 7.96 | 8.63 | 7.51 | 7.02 | 8.59 | 8.00 | 8.63 | 5.38 | 6.20 | 4.89 |

N.B: Figures in parenthesis are square root transformation

Present findings are in confirmation with Rajashekhar *et al*. (2010) [9] who reported that the module comprising of seed treatment with imidacloprid @ 3 g/kg seed + yellow sticky trap @ 25/ha and need base application of fipronil and neem oil efficacy reduced the aphid, Jassid and WF populations in okra. Bagade *et al*. (2010) [4] also reported that imidacloprid (0.004%) followed by cypermethrin (0.01%), was found promising in checking the population of aphids and jassids infesting okra. Findings are also in agreement with Boopathi *et al*. (2010) [5] reported that he okra when sprayed on schedule base at an interval of 15 days. Result could not be compared for the want of literature on combination of cypermethrin+dimethoate against aphid. Jana *et al* (2006) [7] who reported that fenpropathrin 30 EC 0.1% was the most effective dose in reducing aphid population to 90% and gave maximum higher green chilli yield (95.16 q/ha), followed by fenpropathrin 0.75% and imidacloprid 0.025%.

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