*Int.J.Curr.Microbiol.App.Sci* (2023) *12*(04): 161-167

*International Journal of Current Microbiology and Applied Sciences*
***ISSN: 2319-7706*** **Volume 12 Number 4 (2023)**
Journal homepage: http://www.ijcmas.com

**Original Research Article** https://doi.org/10.20546/ijcmas.2023.1204.018

# Response of Honeybees to Different Insecticides in Safflower, *Carthamus tinctorius* L.

**Gangurde Shaligram Maharu*, P. S. Neharkar, P. R. Zanwar, S. D. Bantewad, Syed Ismail, M. M. Sonkamble and S. B. Ghuge**

*Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani-431 402, M.S., India*

**Corresponding author*

**Keywords**

Honey bees, cyantraniliprole, neonicotinoid, safflower, spinetoram

**Article Info**

***Received:***
06 March 2023
***Accepted:***
04 April 2023
***Available Online:***
10 April 2023

**A B S T R A C T**

The field trial on response of different species of honeybees to the insecticides in safflower was conducted at research farm of Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during 2020-21 and 2021-22.The studies revealed that the maximum number of honeybees population of *Melipona irridipenis* (7.28 bees /$m^2$ /min.), *Apis dorsata* (5.70 bees /$m^2$ /min.), *Apis cerana indica* (4.95 bees /$m^2$ /min.), *Apis florea* (4.26 bees /$m^2$ /min.) and *Apis mellifera* (3.52 bees /$m^2$ /min.) was recorded in an untreated control plot followed by the treatment seed treatment with thiamethoxam 30 FS @ 10 ml/kg seed and seed treatment with imidacloprid 48 FS @ 9 ml/kg seed in which 5.63, 5.48, 4.78, 4.08, 3.34 and 5.67, 4.98, 4.29, 3.57, 3.16 *M. irridipenis*, *A. dorsata*, *A. cerana indica*, *A. florea* and *A. mellifera* bees /$m^2$/min. were recorded, respectively. The next better treatments were soil drenching with clothianidin 50 WDG, seed treatment with thiamethoxam 30 FS and one foliar spray of cyantraniliprole 10.26 OD, seed treatment with thiamethoxam 30 FS and one foliar spray of spinetoram11.70 SC, seed treatment with imidacloprid 48 FS and one foliar spray of cyantraniliprole 10.26 OD, seed treatment with imidacloprid 48 FS and one foliar spray of spinetoram 11.70 SC, soil drenching with clothianidin 50 WDG and one foliar spray of cyantraniliprole 10.26 OD, soil drenching with clothianidin 50 WDG and one foliar spray of spinetoram11.70 SC, two foliar sprays of cyantraniliprole 10.26 OD and two foliar sprays of spinetoram11.70 SC in which honey bees population of *M. irridipenis*, *A. dorsata*, *A. cerana indica*, *A. florea* and *A. mellifera* bees /$m^2$/min. were recorded in the range of 3.63 to 5.30, 2.94 to 4.51, 2.24 to 3.87, 1.58 to 3.08 and 1.00 to 2.74 bees /$m^2$/min., respectively.

## Introduction

Safflower is the oldest cultivated oilseed crop which is well adapted to dry regions of Maharashtra and Karnataka states in India. It is one of the most important oilseed crops in Maharashtra State mainly grown in two agroclimatic zones viz., scarcity zone and assured rainfall zone. The oil of this crop contains high amount of polyunsaturated fatty acids and high linoleic acid (75 to 80 per cent) which is best for heart patients for reducing blood cholesterol level (Rangarao, 1984).

The safflower crop is damaged by as high as 79 insect pests. Safflower aphid (*Uroleucon compositae* Theobald) is the regular and most destructive pest in India. The losses in yield of safflower due to aphids were 60-80 % (Narayanan, 1961), 55–60% (Suryawanshi and Pawar, 1980), 55.9–67.9% (Basavangoud *et al.,* 1981), and 24.20 – 67.72 % (Shetgar *et al.,* 1992). Therefore, it is the most important pest of safflower. Safflower aphid can be control by different insecticides recommended by many workers. Thiamethoxam 25 WG @ 50, 70 and 100 g.a.i./ha were found most effective than imidacloprid 17.8 SL and dimethoate 30 EC in reducing aphid population (Wadnerkar *et al.,* 2004). Akashe *et al.,* (2007) reported that thiamethoxam 0.005 per cent was effective for the control of safflower aphid. All these insecticides are neonicotinoids which are used for the control of safflower aphid and these insecticides are systemic in nature and absorbed by the plant and transferred through the vascular system making the plant itself toxic to insects. These insecticides can be present in pollen and nectar making them toxic to the pollinators especially honeybees that feed on them.

The neonicotinoid insecticides viz., imidacloprid, acetamiprid, thiamethoxam show very strong toxicity to pollinating insects and in particular to the honey bee (*Apis mellifera* L.), causing also other effects which are seldom easily identifiable, such as behavioral disturbances, orientation difficulties and impairment of social activities (e.g. Bortolotti *et al.,* 2003; Decourtye *et al.,* 2004a; 2004b; Hassani El *et al.,* 2008). Clothianidin, dinotefuran, imidacloprid and thiamethoxam are highly toxic to honeybees by contact and ingestion. Honey bees exposed to sublethal levels of neonicotinoids can experience problems with flight and navigation, reduced taste sensitivity and slower learning of new tasks all of which impact foraging ability and hive productivity.

Larvae of honeybees exposed to sublethal doses of imidacloprid in brood had reduced survival and pupation altered metabolism and reduced olfactory response as adults (Hopewood *et al.,* 2016). The indiscriminate and frequent application of insecticides responsible for the destruction of natural enemies and different pollinators especially honeybees. It was, therefore necessary to evaluate the efficacy of different seed treatment insecticides as well as foliar application of insecticides to find out the insecticides harmful to the aphids and safer to the natural enemies and honeybees. Therefore, the seed treatment insecticides and newer insecticides were investigated to evaluate the response of honeybees to insecticides in safflower.

## Materials and Methods

The field trial was carried out to test the response of honeybees to different insecticides in safflower during the *rabi* season of 2020-21 and 2021-22 at the Research Farm of Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The seed treatment with imidacloprid 48 FS and thiamethoxam 30 FS was done before sowing and soil drenching of clothianidin 50 WDG was done at 15 days after sowing as per the treatment. The sowing of safflower variety PBNS-12 was done in randomized block design with three replications by dibbling at a spacing of 45x20 cm.

The first spray of insecticides was applied on appearance of sufficient population of safflower aphid while second spray was given at an interval of 15 days as per the treatment. The observations on foraging behaviour from 10% flowering to cessation of flowering of the crop were recorded. The area of 1 x 1 $m^2$ was randomly demarcated by bamboo sticks in each treatment plot for recording observations and numbers of different honeybee species visiting safflower per minute were recorded at two hourly intervals from 06.00 hrs. to 18.00 hrs.

These observations were recorded at weekly interval after 10 percent flowering. In addition to the respective domesticated bees, the abundance of various honey bees species from the safflower crop was also recorded. The data obtained on honeybees in different treatments was averaged and subjected to analysis as per Gomez and Gomez (1976).

## Results and Discussion

The data presented in Table 2 indicated that there was less number of honeybees after 10 percent flowering. The insecticides had adverse effect on foraging behaviour of honeybees *viz*., *Apis mellifera, Apis florea, Apis cerana indica*, *Apis dorsata* and *Melipona irridipenis* on safflower crop.

### *Apis mellifera*

The visits of *Apis mellifera* bees to the safflower crop are presented in Table 2. The data presented in Table 2 showed that the mean number of *A.mellifera* bees /$m^2$/minute varied across all treatments from 1.00 to 3.52. The untreated control had the highest bee visits (3.52 bees/$m^2$/min), followed by the seed treatments with thiamethoxam 30 FS (3.34 bees/$m^2$/min) and seed treatments with imidacloprid 48 FS (3.16 bees/$m^2$/min), which were at par with each other. The next treatments, in descending order of effectiveness were soil drenching with clothianidin 50 WDG (2.74 bees/$m^2$/min) and seed treatment with thiamethoxam 30 FS & one foliar spray of cyantraniliprole 10.26 OD (2.50 bees/$m^2$/min) which were found at par with each other.

The next better treatments were seed treatment with thiamethoxam 30 FS & one foliar spray of spinetoram11.70 SC, seed treatment with imidacloprid 48 FS & one foliar spray of cyantraniliprole 10.26 OD, seed treatment with imidacloprid 48 FS & one foliar spray of spinetoram11.70 SC and soil drenching with clothianidin 50 WDG and one foliar spray of cyantraniliprole 10.26 OD in which 2.16, 2.10, 1.79 and 1.68 bees/$m^2$/minute, respectively were recorded. These four treatments were statistically at par with each other. The next remaining treatments, soil drenching with clothianidin 50 WDG and one foliar spray of spinetoram11.70 SC, two foliar sprays of cyantraniliprole 10.26 OD and two foliar sprays of spinetoram11.70 SC recorded 1.37, 1.12 and 1.00 bees/$m^2$/minute, respectively.

### *Apis florea*

It is revealed from the Table 2 that the overall effects of insecticides on visits of *Apis florea* on safflower crop varied from 1.58 to 4.26 bees /$m^2$/minute in all the treatments. In an untreated control, the highest number of bees were recorded (4.26 bees/$m^2$/min.) followed by Seed treatment with thiamethoxam 30 FS and seed treatment with imidacloprid 48 FS which were statistically at par with each other by recording 4.08 and 3.57 bees/$m^2$/min., respectively. The next better treatments in order of merit were soil drenching with clothianidin 50 WDG, seed treatment with thiamethoxam 30 FS & one foliar spray of cyantraniliprole 10.26 OD, seed treatment with thiamethoxam 30 FS & one foliar spray of spinetoram11.70 SC, seed treatment with imidacloprid 48 FS & one foliar spray of cyantraniliprole 10.26 OD and seed treatment with imidacloprid 48 FS & one foliar spray of spinetoram11.70 SC which were at par with each other and recorded 3.08, 2.91, 2.79, 2.53 and 2.46 bees/$m^2$/min., respectively. The next remaining treatments recorded bees in the range of 1.58 to 2.08 bees/$m^2$/minute.

### *Apis cerana indica*

The data presented in the Table 3 revealed that visits of *Apis cerana indica* on safflower crop ranged from 2.24 to 4.95 bees /$m^2$/minute in all the treatment plots. The untreated control treatment recorded highest 4.95 bees/$m^2$/minute followed by seed treatment with thiamethoxam 30 FS (4.78 bees/$m^2$/min.) and seed treatment with imidacloprid 48 FS (4.29 bees/$m^2$/min.) which were statistically at par with each other. The next better treatments in order of merit were soil drenching with clothianidin 50 WDG and seed treatment with thiamethoxam 30 FS & one foliar spray of cyantraniliprole 10.26 OD, seed treatment with thiamethoxam 30 FS & one foliar spray of spinetoram11.70 SC, seed treatment with imidacloprid 48 FS & one foliar spray of cyantraniliprole 10.26 OD which were at par with each other and recorded 3.87, 3.66, 3.45 and 3.26

bees/$m^2$/min., respectively. The next remaining treatments recorded less number of bees varied from 2.24 to 3.10 bees/$m^2$/minute.

### *Apis dorsata*

It is revealed from Table 3 that the visits of *Apis dorsata* on safflower crop were found in the range of 2.94 to 5.70 bees /$m^2$/minute in all the treatment plots. The highest number of 5.70 bees /$m^2$/minute was recorded in an untreated control treatment followed by seed treatment with thiamethoxam 30 FS (5.48 bees/$m^2$/min.) and seed treatment with imidacloprid 48 FS (4.98 bees/$m^2$/min.) which were at par with each other. The next better treatments were soil drenching with clothianidin 50 WDG and seed treatment with thiamethoxam 30 FS & one foliar spray of cyantraniliprole 10.26 OD, seed treatment with thiamethoxam 30 FS & one foliar spray of spinetoram11.70 SC, seed treatment with imidacloprid 48 FS & one foliar spray of cyantraniliprole 10.26 OD and seed treatment with imidacloprid 48 FS & one foliar spray of spinetoram11.70 SC were recorded 4.51, 4.36, 4.15, 3.98 and 3.83 bees/$m^2$/min., respectively which were at par with each other. The comparatively fewer number of bees were recorded in next remaining treatments (2.94 to 3.51 bees/$m^2$/minute).

### *Melipona irridipenis*

The visits of *Melipona irridipenis* on safflower crop was varied from 3.63 to 7.28 bees /$m^2$/minute in all the treatment plots (Table 4).The highest number of 7.28 bees /$m^2$/minute was recorded in an untreated control plot. The treatments with seed treatment with imidacloprid 48 FS, seed treatment with thiamethoxam 30 FS, soil drenching with clothianidin 50 WDG and seed treatment with thiamethoxam 30 FS & one foliar spray of cyantraniliprole 10.26 OD recorded 5.67, 5.63, 5.30 and 5.13 bees/$m^2$/min., respectively. The next treatment with seed treatment with thiamethoxam 30 FS & one foliar spray of spinetoram11.70 SC, seed treatment with imidacloprid 48 FS & one foliar spray of cyantraniliprole 10.26 OD and Seed treatment with imidacloprid 48 FS & one foliar spray of spinetoram 11.70 SC were at par with each other which recorded 4.89, 4.67 and 4.48 bees/$m^2$/min., respectively. The next remaining treatments recorded fewer number of bees varied from 3.63 to 4.21 bees/$m^2$/minute. The overall study on effects of insecticides on foraging behaviour of different species of honeybees revealed that the lowest number of honey bee visits was found in plots treated with two foliar sprays of spinetoram11.70 SC followed by two foliar sprays of cyantraniliprole 10.26 OD, soil drenching with clothianidin 50 WDG and one foliar spray of spinetoram11.70 SC, soil drenching with clothianidin 50 WDG and one foliar spray of cyantraniliprole 10.26 OD, seed treatment with imidacloprid 48 FS and one foliar spray of spinetoram11.70 SC, seed treatment with imidacloprid 48 FS and one foliar spray of cyantraniliprole 10.26 OD, seed treatment with thiamethoxam 30 FS and one foliar spray of spinetoram11.70 SC, seed treatment with thiamethoxam 30 FS and one foliar spray of cyantraniliprole 10.26 OD, soil drenching with clothianidin 50 WDG, seed treatment with imidacloprid 48 FS and seed treatment with thiamethoxam 30 FS, respectively. The treatments found more toxic to the foraging behaviour of honeybees in order of toxicity were two foliar sprays of spinetoram11.70 SC > two foliar sprays of cyantraniliprole 10.26 OD > soil drenching with clothianidin 50 WDG and one foliar spray of spinetoram11.70 SC > soil drenching with clothianidin 50 WDG and one foliar spray of cyantraniliprole 10.26 OD > seed treatment with imidacloprid 48 FS and one foliar spray of spinetoram11.70 SC > seed treatment with imidacloprid 48 FS and one foliar spray of cyantraniliprole 10.26 OD > seed treatment with thiamethoxam 30 FS and one foliar spray of spinetoram11.70 SC > seed treatment with thiamethoxam 30 FS and one foliar spray of cyantraniliprole 10.26 OD > soil drenching with clothianidin 50 WDG > seed treatment with imidacloprid 48 FS > seed treatment with thiamethoxam 30 FS.

According to the studies on the effects of insecticides on foraging activity of honey bees in safflower, all the insecticidal treatments showed more or less similar repelling effect on the foraging bees. However, the bee activity was gradually increased at every week in all the insecticidal treatment plots. Highest number of foraging bees *viz.*, *Apis mellifera, Apis cerana indica, Apis dorsata, Apis florea and Melipona irridipenis* were observed in the untreated control plots followed by the seed treatments with thiamethoxam 30 FS and seed treatments with imidacloprid 48 FS, which were at par with each other.

**Table.1** Treatment details

| Sr.No. | Treatment | Dose |
|---|---|---|
| **1** | Seed treatment with imidacloprid 48 FS | 9 ml/kg seed |
| **2** | Seed treatment with thiamethoxam 30 FS | 10 ml/kg seed |
| **3** | Soil drenching with clothianidin 50 WDG | 2.5 g/10 lit. water |
| **4** | Seed treatment with imidacloprid 48 FS and one foliar spray of spinetoram11.70 SC | 9 ml/kg seed and 420 ml/ha |
| **5** | Seed treatment with imidacloprid 48 FS and one foliar spray of cyantraniliprole 10.26 OD | 9 ml/kg seed and 900 ml/ha |
| **6** | Seed treatment with thiamethoxam 30 FS and one foliar spray of spinetoram11.70 SC | 10 ml/kg seed and 420 ml/ha |
| **7** | Seed treatment with thiamethoxam 30 FS and one foliar spray of cyantraniliprole 10.26 OD | 10 ml/kg seed and 900 ml/ha |
| **8** | Soil drenching with clothianidin 50 WDG and one foliar spray of spinetoram11.70 SC | 2.5 g/10 lit. water and 420 ml/ha |
| **9** | Soil drenching with clothianidin 50 WDG and one foliar spray of cyantraniliprole 10.26 OD | 2.5 g/10 lit. water and 900 ml/ha |
| **10** | Two foliar sprays of spinetoram11.70 SC | 420 ml/ha |
| **11** | Two foliar sprays of cyantraniliprole 10.26 OD | 900 ml/ha |
| **12** | Untreated control | -- |

**Table.2** Effect of insecticides on visits of honeybees in safflower (Pooled mean 2020-21 to 2021-22)

| Sr. No. | Treatment | Dose/ha | Mean number of honeybees/$m^2$/min. | | | | |
|---|---|---|---|---|---|---|---|
| | | | ***Apis mellifera*** | ***Apis florea*** | ***Apis cerana indica*** | ***Apis dorsata*** | ***M.irridipenis*** |
| **1** | Seed treatment with imidacloprid 48 FS | 9 ml/kg seed | 3.16 (1.91)* | 3.57 (2.02) | 4.29 (2.19) | 4.98 (2.34) | 5.67 (2.48) |
| **2** | Seed treatment with thiamethoxam 30 FS | 10 ml/kg seed | 3.34 (1.96) | 4.08 (2.14) | 4.78 (2.30) | 5.48 (2.45) | 5.63 (2.48) |
| **3** | Soil drenching with clothianidin 50 WDG | 2.5 g/10 lit. water | 2.74 (1.80) | 3.08 (1.89) | 3.87 (2.09) | 4.51 (2.24) | 5.30 (2.41) |
| **4** | Seed treatment with imidacloprid 48 FS and one foliar spray of spinetoram11.70 SC | 9 ml/kg seed and 420 ml/ha | 1.79 (1.51) | 2.46 (1.72) | 3.10 (1.90) | 3.83 (2.08) | 4.48 (2.23) |
| **5** | Seed treatment with imidacloprid 48 FS and one foliar spray of cyantraniliprole 10.26 OD | 9 ml/kg seed and 900 ml/ha | 2.10 (1.61) | 2.53 (1.74) | 3.26 (1.94) | 3.98 (2.12) | 4.67 (2.27) |
| **6** | Seed treatment with thiamethoxam 30 FS and one foliar spray of spinetoram11.70 SC | 10 ml/kg seed and 420 ml/ha | 2.16 (1.63) | 2.79 (1.81) | 3.45 (1.99) | 4.15 (2.16) | 4.89 (2.32) |
| **7** | Seed treatment with thiamethoxam 30 FS and one foliar spray of cyantraniliprole 10.26 OD | 10 ml/kg seed and 900 ml/ha | 2.50 (1.73) | 2.91 (1.85) | 3.66 (2.04) | 4.36 (2.20) | 5.13 (2.37) |
| **8** | Soil drenching with clothianidin 50 WDG and one foliar spray of spinetoram11.70 SC | 2.5 g/10 lit. water and 420 ml/ha | 1.37 (1.37) | 1.79 (1.51) | 2.60 (1.76) | 3.32 (1.95) | 4.04 (2.13) |
| **9** | Soil drenching with clothianidin 50 WDG and one foliar spray of cyantraniliprole 10.26 OD | 2.5 g/10 lit. water and 900 ml/ha | 1.68 (1.48) | 2.08 (1.61) | 2.83 (1.82) | 3.51 (2.00) | 4.21 (2.17) |
| **10** | Two foliar sprays of spinetoram11.70 SC | 420 ml/ha | 1.00 (1.23) | 1.58 (1.44) | 2.24 (1.66) | 2.94 (1.85) | 3.63 (2.03) |
| **11** | Two foliar sprays of cyantraniliprole 10.26 OD | 900 ml/ha | 1.12 (1.27) | 1.74 (1.50) | 2.41 (1.71) | 3.10 (1.90) | 3.84 (2.08) |
| **12** | Untreated control | -- | 3.52 (2.00) | 4.26 (2.18) | 4.95 (2.33) | 5.70 (2.49) | 7.28 (2.79) |
| | **S.E.±** | | 0.05 | 0.06 | 0.06 | 0.07 | 0.04 |
| | **C.D. at 5%** | | 0.15 | 0.17 | 0.17 | 0.21 | 0.13 |
| | **CV %** | | 5.38 | 5.79 | 5.15 | 5.86 | 3.33 |

* Figures in parentheses are √x+0.5 transformed values

## References


Akashe, V. B., Ghadge, S. M., Gud, M. A., Kale, S. D., Kankal, V. Y. & Deshpande, A. N., 2007. Efficacy of some newer insecticides for the control of safflower aphid (*Uroleucon compositae* Theobald). In Abst.*ISOR Nation Semi*. January 29-31, pp.191-192.

Basavangoud, K., Kulkarni, R. A. & Thontadarya, T. S. (1981). Estimation of crop loss in safflower due to the aphid *Dactynotus compositae* Theobald (*Hemiptera aphididae*). *Mysore J. Agric. Sci.* 15, 279–282.

Bortolotti L, Montanari R, Marcelino J, Medrzycki P, Maini S, Porrini C. Effects of sub-lethal imidacloprid doses on the homing rate and foraging activity of honey bees. Bulletin of Insectology. 2003; 56(1):63-67.

Decourtye A, Armengaud C, Renou M, Devillers J, Cluzeau S, Gauthier M. (2004a) Imidacloprid impairs memory and brain metabolism in the honeybee (*Apis mellifera* L.). Pesticide Biochemistry and Physiology. 78:83-92. https://doi.org/10.1016/j.pestbp.2003.10.001

Decourtye A, Devillers J, Cluzeau S, Charreton M, Pham Delegue M H. (2004b) Effects of imidacloprid and deltamethrin on associative learning in honeybees under semi-field and laboratory conditions. Ecotoxicology and Environmental Safety.57:410-419. https://doi.org/10.1016/j.ecoenv.2003.08.001

Gomez, K. A. and Gomez, A. A. (1976). Statistical procedures for agricultural research. John Wiley and Sons. New York. Pp. 643-645.

Hassani El, A. K., Dacher, M., Gary. V., Lambin. M., Gauthier, M. and Armengaud, C., 2008. Effects of sublethal doses of Acetamiprid and Thiamethoxam on the behaviour of honey bee (*Apis mellifera*). *Archives Environmental Contamination Toxicology, 54: 653-661*. https://doi.org/10.1007/s00244-007-9071-8

Hopewood, J., Code, A., Vaughan, M., Biddinger, D., Shepherd, M., Black, S. H., Mader, E. L. & Mazzacano, C. (2016). *How Neonicotinoids Can Kill Bees: The Science Behind the Role These Insecticides Play in Harming Bees*. 2nd Edition,70 pp. Portland, The Xerces Society for Invertebrate Conservation.

Narayanan, E. S.1961. Insect pests of safflower and methods of their control in niger and safflower. Ed. Chavan, V.M. Pub. Indian Cent. Oilseeds Comm., Hyderabad.

Rangarao, V. (1984). Improved technologies in oilseeds. Directorate of oilseeds, ICAR, Hyderabad (India), pp:42-49.

Shetgar, S. S., Bilapte, G. G., Puri, S. N., Patil, V. V. & Londhe, G. M. (1992). Assessment of yield loss in safflower due to aphids. *J. Maharashtra Agric. Univ.* 17, 303–304.

Suryawanshi, D. & Pawar, V. M., 1980. Effect on the growth and yield due to aphid *Dactynotus sonchi* in safflower. Proc.Indian Sci. 89, 347–349.

Wadnerkar, D. W., Zanwar, P. R., Sangle, P. D. & Bhosale, A. M., 2004. Field evaluation of thiamethoxam (Taurus 25 WG) against sucking pests of cotton. *In : Int. Symp. on "Strat. of Sust. cotton Prod. A Global Vision 3*. Univ. Agric., Sci., Nov. 23-25, pp. 190-191.


**How to cite this article:**

Gangurde Shaligram Maharu, P. S. Neharkar, P. R. Zanwar, S. D. Bantewad, Syed Ismail, M. M. Sonkamble and Ghuge, S. B. 2023. Response of Honeybees to Different Insecticides in Safflower, *Carthamus tinctorius* L. *Int.J.Curr.Microbiol.App.Sci.* 12(04): 161-167.
**doi:** https://doi.org/10.20546/ijcmas.2023.1204.018