The Pharma Innovation Journal 2021; SP-10(10): 417-420

www.ThePharmaJournal.com

The Pharma Innovation

**ISSN (E): 2277- 7695**
**ISSN (P): 2349-8242**
**NAAS Rating: 5.23**
TPI 2021; SP-10(10): 417-420

www.thepharmajournal.com
Received: 02-08-2021
Accepted: 15-09-2021

**Udtewar PG**
Department of Agril. Entomology, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

**Bhede BV**
Department of Agril. Entomology, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

**Khandare AS**
Department of Agril. Entomology, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

**Corresponding Author**
**Udtewar PG**
Department of Agril. Entomology, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

# Relative toxicity of insecticides against various species of aphids

**Udtewar PG, Bhede BV and Khandare AS**

**Abstract**
The studies were carried out at laboratory at Department of Agricultural Entomology, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during 2020-21. Leaf dip bioassay method was conducted to study the relative toxicity of different insecticides against various species of aphids using IRAC Susceptibility Test Method 019 with some modifications. Commercial formulations of different insecticides used for bioassays comprised of Imidacloprid 17.8% SL, Thiamethoxam 25% WG, Acetamiprid 20% SP, Flonicomid 50% WG and Fipronil 5% SC. Serial dilutions as parts per million of active ingredients of the test insecticides were prepared using distilled water. Results shown that all the insecticides were more toxic to *R.maidis* followed by *A. craccivora, L.erysimi, U. compositae, B. brassicae and A. gossypii.*

**Keywords:** Insecticides, toxicity, bioassay, formulations, toxic.

## Introduction
The farmers mostly rely on synthetic insecticides for management of pests. Pest resistance to pesticides is an increasing problem because pesticides are an integral part of high-yielding production agriculture. When few products are labeled for an individual pest within a particular crop system, chemical control options are limited. Therefore, the same product(s) are used repeatedly and continual selection pressure is placed on the target pest. There are both financial and environmental costs associated with the development of resistant populations. There have been number of reports on the efficacy of insecticides against aphids on different crops. However, intensive cropping and climate change has increased the severity of the pests. In order to have effective control it was felt necessary to study relative efficacy of newer insecticides against aphids on different crops. Outcome of the present investigation will be very much useful to cultivators for the management of aphids of any crop from the point of view of integrated pest management. It will also be useful to research worker for carrying out further research work on this aspect.

## Material and methods
### Experimental site
Relative toxicity of insecticides were carried out at laboratory at Department of Agricultural Entomology, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.

### Materials used
Small (3-5cm diameter) plastic pots, plastic pot lids, forceps, sharpened metal tube for cutting leaf discs, agar powder, fine pointed brush, beakers for test liquids, syringes/pipettes for liquids or weighing balance for solids, syringes/pipettes for making dilutions, hand lens, untreated leaves of a host plant, tissue papers, insecticides, agar etc.

### Experimental details
Leaf dip bioassay method was conducted to study the relative toxicity of different insecticides against various species of aphids using IRAC Susceptibility Test Method 019 with some modifications as per aphid species (Anonymous, 2016). Commercial formulations of different insecticides used for bioassays comprised of Imidacloprid 17.8% SL, Thiamethoxam 25% WG, Acetamiprid 20% SP, Flonicomid 50% WG and Fipronil 5% SC. Serial dilutions as parts per million of active ingredients of the test insecticides were prepared using distilled water.

## Results and discussion

### Imidacloprid 17.8 SL

The highest $LC_{50}$ of imidacloprid was recorded against *A. gossypii* (34.577 ppm). The lowest $LC_{50}$ was noticed against *R. maidis* (9.028 ppm). Values ranged from 9.028 to 34.577 ppm. The relative toxicity of imidacloprid against different aphid species in increasing order was *R. maidis* (9.028ppm), *A.craccivora* (13.913ppm) *L. erysimi* (17.968ppm) *U. compositae* (20.048 ppm), *B. brassicae* (29.174 ppm) and *A.gossypii* (34.577 ppm).

### Thiamethoxam 25 WG

It was seen that thiamthoxam was most toxic to *R. maidis* ($LC_{50}$ value 14.281 ppm). It was followed by *A. craccivora*, *L. erysimi*, *U. compositae*, *B. brassicae* and *A.gossypii* with 15.989, 20.809, 24.565, 35.084 and 40.713 ppm $LC_{50}$ values, respectively. As $LC_{50}$ of thiamethoxam was highest against *A. gossypii*, it was least toxic to *A. gossypii* as compared to other species of aphids.

### Acetamiprid 20 SP

The $LC_{50}$ values of acetamiprid 20 SP ranged from 10.589 to 29.526 ppm. The toxicity of acetamiprid against different species of aphids in increasing order is *A. gossypii*, *B. brassicae*, *U. compositae*, *L. erysimi*, *A. craccivora* and *R. maidis* with 29.526, 26.159, 18.087, 16.106, 11.501 and 10.589 ppm $LC_{50}$ values, respectively.

### Fipronil 5 SC

The $LC_{50}$ value here ranged from 24.846 to 43.993 ppm. The lowest $LC_{50}$ value was observed against *R. maidis* indicating most toxic to it among all species of aphids. While it was highest toxic to *A. gossypii*. The relative toxicity of fipronil against different aphid species in decreasing order was *R. maidis, L. erysimi, A. craccivora, U. compositae, B. brassicae and A. gossypii* with 24.846, 25.640, 27.025, 30.309, 40.282 and 43.993 ppm $LC_{50}$ values, respectively.

### Flonicamid 50 WG

The results shown that that flonicamid was most toxic to *R. maidis* with lowest $LC_{50}$ value (6.682 ppm). The highest $LC_{50}$ value was observed against *A. gossypii* (14.204 ppm) The $LC_{50}$ values of flonicamid against different species of aphids in increasing order were 6.682, 10.272, 10.829, 11.310, 11.675 and 14.204 ppm against *R. maidis, A. craccivora, L.erysimi, U. compositae, B. brassicae and A. gossypii*, respectively.

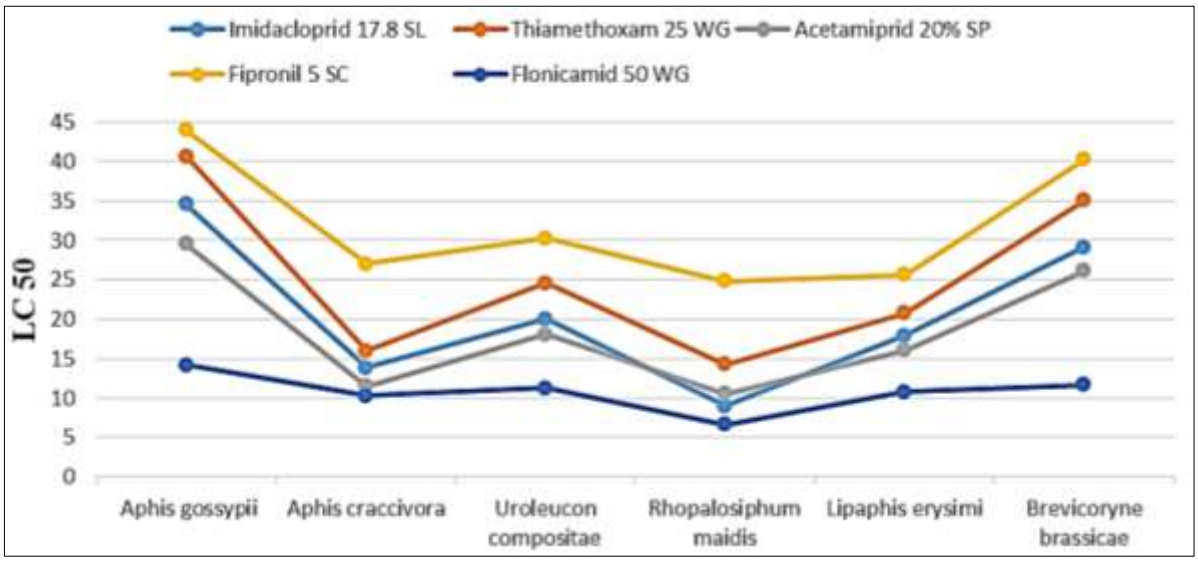


**Fig 1:** LC 50 values of insecticides against various aphid species

**Table 1:** Relative toxicity of Imidacloprid 17.8 % SL against different species of aphid

| Sr. No. | Aphid species | $LC_{50}$ (ppm) | Fiducial limit (ppm) | $LC_{90}$ (ppm) | Chi square value | df |
|---|---|---|---|---|---|---|
| 1 | *Aphis gossypii* | 34.577 | 12.644 - 94.558 | 4609.818 | 2.848 | 3 |
| 2 | *Aphis craccivora* | 13.913 | 4.766 - 40.613 | 2993.118 | 1.183 | 3 |
| 3 | *Uroleucon compositae* | 20.048 | 6.997 - 57.442 | 3773.730 | 1.900 | 3 |
| 4 | *Rhopalosiphum maidis* | 9.028 | 3.874 - 21.039 | 454.049 | 1.663 | 3 |
| 5 | *Lipaphis erysimi* | 17.968 | 5.890 - 54.809 | 5024.254 | 0.719 | 3 |
| 6 | *Brevicoryne brassicae* | 29.174 | 9.809 - 86.765 | 6722.394 | 0.941 | 3 |

**Table 2:** Relative toxicity of Thiamethoxam 25 % WG against different species of aphid

| Sr. No. | Aphid species | $LC_{50}$ (ppm) | Fiducial limit (ppm) | $LC_{90}$ (ppm) | Chi square value | df |
|---|---|---|---|---|---|---|
| 1 | *Aphis gossypii* | 40.713 | 15.027 – 110.307 | 5009.420 | 4.430 | 3 |
| 2 | *Aphis craccivora* | 15.983 | 5.557 – 45.971 | 3119.347 | 2.091 | 3 |
| 3 | *Uroleucon compositae* | 24.565 | 8.528 – 70.762 | 4709.580 | 1.200 | 3 |
| 4 | *Rhopalosiphum maidis* | 14.281 | 5.842 – 34.911 | 984.524 | 1.357 | 3 |
| 5 | *Lipaphis erysimi* | 20.809 | 6.763 – 64.023 | 6082.471 | 0.800 | 3 |
| 6 | *Brevicoryne brassicae* | 35.084 | 11.763 – 104.640 | 8067.694 | 0.638 | 3 |

**Table 3:** Relative toxicity of Acetamiprid 20 % SP against different species of aphid

| Sr. No. | Aphid species | $LC_{50}$ (ppm) | Fiducial limit (ppm) | $LC_{90}$ (ppm) | Chi square value | df |
|---|---|---|---|---|---|---|
| 1 | *Aphis gossypii* | 29.526 | 11.091 – 78.606 | 3374.683 | 4.873 | 3 |
| 2 | *Aphis craccivora* | 11.501 | 4.086 – 32.369 | 1977.257 | 3.988 | 3 |
| 3 | *Uroleucon compositae* | 18.087 | 6.593 – 49.621 | 2605.034 | 2.769 | 3 |
| 4 | *Rhopalosiphum maidis* | 10.589 | 4.419 – 25.375 | 643.055 | 0.426 | 3 |
| 5 | *Lipaphis erysimi* | 16.106 | 5.411 – 47.936 | 3888.426 | 1.923 | 3 |
| 6 | *Brevicoryne brassicae* | 26.159 | 8.890 – 76.970 | 5696.275 | 1.091 | 3 |

**Table 4:** Relative toxicity of Fipronil 5 % SC against different species of aphid

| Sr. No. | Aphid species | $LC_{50}$ (ppm) | Fiducial limit (ppm) | $LC_{90}$ (ppm) | Chi square value | df |
|---|---|---|---|---|---|---|
| 1 | *Aphis gossypii* | 43.993 | 17.890 – 108.179 | 2854.340 | 5.501 | 3 |
| 2 | *Aphis craccivora* | 27.025 | 11.330 – 64.462 | 1518.239 | 5.389 | 3 |
| 3 | *Uroleucon compositae* | 30.309 | 12.921 – 71.100 | 1505.399 | 0.676 | 3 |
| 4 | *Rhopalosiphum maidis* | 24.846 | 10.770 – 57.317 | 1122.906 | 4.578 | 3 |
| 5 | *Lipaphis erysimi* | 25.640 | 9.906 – 66.364 | 2478.065 | 4.910 | 3 |
| 6 | *Brevicoryne brassicae* | 40.282 | 16.146 – 100.495 | 2909.539 | 1.826 | 3 |

**Table 4.15:** Relative toxicity of Flonicamid 50 % WG against different species of aphid

| Sr. No. | Aphid species | $LC_{50}$ (ppm) | Fiducial limit (ppm) | $LC_{90}$ (ppm) | Chi square value | df |
|---|---|---|---|---|---|---|
| 1 | *Aphis gossypii* | 14.204 | 5.328 – 37.871 | 1723.476 | 4.801 | 3 |
| 2 | *Aphis craccivora* | 10.272 | 3.860 – 27.338 | 1239.554 | 2.906 | 3 |
| 3 | *Uroleucon compositae* | 11.310 | 4.250 – 30.097 | 1362.745 | 1.274 | 3 |
| 4 | *Rhopalosiphum maidis* | 6.682 | 2.727 – 16.078 | 435.764 | 0.726 | 3 |
| 5 | *Lipaphis erysimi* | 10.829 | 3.921 – 29.904 | 1652.301 | 3.041 | 3 |
| 6 | *Brevicoryne brassicae* | 11.675 | 4.578 – 29.773 | 1067.972 | 4.597 | 3 |

## Conclusion

In the present studies, imidacloprid, thiamethoxam, acetamiprid, fipronil and flonicamid were more toxic to *R.maidis* followed by *A. craccivora, L.erysimi, U. compositae, B. brassicae and A. gossypii.* More the LC50 value less toxic is the insecticide. The $LC_{50}$ values of imidacloprid, thiamethoxam, acetamiprid, fipronil and flonicamid were ranged from 9.028 to 34.577 ppm, 14.281 to 40.713 ppm, 10.589 to 29.526 ppm, 24.846 to 43.993 ppm and 6.682 to 14.204 ppm, respectively against various species of aphids. Imidacloprid, thiamethoxam, acetamiprid, fipronil and flonicamid were more toxic to *R. maidis* followed by *A. craccivora, L.erysimi, U. compositae, B. brassicae and A. gossypii.* i.e. cotton aphid *A. gossypii* had more LC50 values.

## References


1. Amini Jam N, Kocheili F, Mossadegh MS, Rasekh A, Saber M. Lethal and sublethal effects of imidacloprid and pirimicarb on the melon aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae) under laboratory conditions. Journal of Crop Protection 2014;3(1):89-98.
2. Awasthi NS, Barkhade UP, Patil SR, Lande GK. Comparative toxicity of some commonly used insecticides to cotton aphid and their safety to predatory coccinellids. The Bioscan 2013;8(3):1007-1010.
3. Cho Sun-Ran, Koo Hyun-Na, Yoon Changmann, Kim Gil-Ha. Sublethal effects of flonicamid and thiamethoxam on green peach aphid, *Myzus persicae* and feeding behavior analysis. Journal of the Korean Society for Applied Biological Chemistry 2011;54(6):889-898.
4. Devee A, Tungkhang S, Baruah AALH, Bhattacharyya B. Efficacy of certain insecticides against *Lipaphis erysimi* (Kalt.) and their relative toxicity against predatory coccinellid beetle. Pesticide Research Journal 2011;23(2):140-145.
5. Dhawan AK, Mohindru B, Saini S, Singh K. Comparative Toxicity of Selected Insecticides against Cotton Aphid, *Aphis gossypii* Glover. Pesticide Research Journal 2008;20(1):89-91.
6. Gaikwad, Bhayasaheb Bhimrao, Shetgar SS. Bioefficacy and residual toxicity of different insecticides against safflower aphids (*Uroleucon compositae* Theobaid). M.sc. Dissertation 2013.
7. Gore J, Cook D, Catchot A, Leonard BR, Stewart SD, Lorenz G *et al.* Cotton aphid (Heteroptera: Aphididae) susceptibility to commercial and experimental insecticides in the southern United States. Journal of Economic Entomology 2013;106(3):1430-1439.
8. Halder J, Kodandaram MH, Rai AB. Differential response of major vegetable aphids to newer insecticides molecules. Vegetable Sciences 2011;38(2):191-193
9. Jadhao PB, Kadam DR, Kangale GK, Jadhav RD. Pomegranate aphid management with insecticides. Journal of Entomology and Zoological studies 2018;7(1):750-753.
10. Jhansi K, Subbaratnam GV. Assessment of Insecticide resistance in the cotton aphid, *Aphis gossypii* Glover, in Andhra Pradesh. Pest Management and Economic Zoology 2005;13(1):61-70.
11. Khalequzzaman M, Nahar J. Relative toxicity of some insecticides and azadirachtin against four crop infesting aphid species. University Journal of Zoology, Rajshahi University 2008;27:31-34.
12. Lashkari MR, Sahragard A, Ghadamyari M. Sublethal effects of imidacloprid and pymetrozine on population growth parameters of cabbage aphid, Brevicoryne brassicae on rapeseed, Brassica napus L. Insect Science 2007;14(3):207-212.
13. Manjarika SB, Sathish K, Baruah AALH, Hazarika LK. Determination of LC50 and relative toxicity of some insecticides against cowpea aphid, Aphis craccivora Koch 2018.
14. Mehdi Taheri Sarhozaki, Seyed Ali Safavi. Sub-lethal effects of thiametoxam on life table parameters of the

cabbage aphid, *Brevicoryne brassicae* (L.) (Hemiptera: Aphididae) under laboratory conditions. Archives of Phytopathology and Plant Protection 2014;47(4):508-515.
15. Mohamed AI, Mohamady AH. Biochemical and Toxicological studies on different field strains of cowpea aphid, *Aphis craccivora* (Koch). Egyptian Academic Journal of Biological Sciences, F. Toxicology & Pest Control 2010;2(1):39-43.
16. Mohammad Rouhani, Mohammad Amin Samih, Hamzeh Izadi, Elham Mohammadi. Toxicity of new insecticides against pomegranate aphid, *Aphis punicae*. International Research Journal of Applied and Basic Sciences 2013;4(3):496-501.
17. Nale Dhananjay appasahaeb. Studies on seasonal occurrence of major insect pests of Cabbage, their natural enemies and Insecticide resistance in Cabbage Aphid. M.Sc Dissertation 2015.
18. Nale DA, Bhede BV, Bharati MS. Insecticide resistance in cabbage aphid Brevicoryne brassicae. Journal of Entomological Research 2016;40(2):187-189.
19. Narangalkar AL, Shivpuje PR. Relative toxicity of some important insecticides against safflower aphid. Journal of Maharashtra Agricultural Universities 1990;15(2):233-234.
20. Patil S, Sridevi D, Babu TR, Pushpavathi B. Relative efficacy of selected insecticides on cowpea aphid, *Aphis craccivora* (Koch). J Entomol Zool Stud 2017;5:1603-1607.
21. Ricupero M, Desneux N, Zappalà L, Biondi A. Target and non-target impact of systemic insecticides on a polyphagous aphid pest and its parasitoid. Chemosphere 2020;247:125728.
22. Shankarganesh K, Suroshe S, Paul B. Relative susceptibility of the Bikaner and Delhi populations of mustard aphid, *Lipaphis erysimi* (Kalt.) (Homoptera: Aphididae), and its predator, *Coccinella septempunctata* L. (Coleoptera : Coccinellidae), to different insecticides. Phytoprotection 2015;95(1):27-31.