International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2022; 10(1): 93-97

Received: 18-11-2021
Accepted: 20-12-2021

Vadher Priteeben Ukabhai
Ph.D. Scholar Department of Entomology, Junagadh Agricultural University, Junagadh, Gujarat, India

Acharya MF
College of Agriculture, JAU, Junagadh, Gujarat, India

Corresponding Author:
Vadher Priteeben Ukabhai
Ph.D. Scholar Department of Entomology, Junagadh Agricultural University, Junagadh, Gujarat, India

Relative toxicity of different insecticides against cumin aphid, *Aphis gossypii* (Glover)

Vadher Priteeben Ukabhai and Acharya MF

DOI: https://doi.org/10.22271/chemi.2022.v10.i1b.12159

Abstract
Present investigations on relative toxicity of different insecticides against aphid, *Aphis gossypii* infesting cumin were carried out under laboratory condition by using leaf dip method of bioassay against adult of aphid during 2019-2020 at Junagadh Agricultural University, Junagadh. The results of the relative toxicity of five selected insecticides showed that imidacloprid was the most toxic as its LC_{50} value 0.00542 per cent. On the other hand, difenthiuron was the less toxic insecticides (LC_{50}=0.1589). Reported the LC_{50} value of different insecticides under test, they can be arranged in descending order as under: Imidacloprid>flonicamid>dimethoate > flupyradifurone > difenthiuron.

Keywords: Cumin, bioassay, relative toxicity, aphid, *A. gossypii*

Introduction
Cumin (Cuminum cyminum Linn.) is an annual herb (2n=14) belongs to the family Apiaceae. Its origin is considered to be Mediterranean region. The area under cumin cultivation in India is about 8.08 lakh ha with annual production of 5.03 lakh MT (Anon., 2018a) [3]. Cumin accounts for 7-8% of India's total spice exports. During 2017-18, total volume of 1.43 lakh tones of cumin valued at Rs 2,418 crore was exported (Anon., 2018b) [4]. Cumin is commercially cultivated in the semi-arid tracts of Gujarat and Rajasthan. In Gujarat, Surendranagar, Banaskatha, Jamnagar and Patan are major cumin producing districts of Gujarat.
The insects are one of the limiting factors for higher production of good quality seeds. Aphid, thrips, cutworm, tobacco caterpillar and root-knot nematode are attacking the cumin crop in field, while cigarette beetle & drugstore beetle are attacking in storage under Indian condition. The aphid is very serious problem on cumin. Both nymphs and adults suck the cell sap from leaves and tender parts, thereby, inducing premature senescence. The situation at present is that most of the insect pests do not respond to insecticidal treatments. The development of insecticide resistance is now one of the major problems in pest management. It causes unexpected crop losses for growers and may put him in a difficult position if no adequate substitutes are available. Multiple applications of products with the same mode of action impose a high selection pressure for resistance development. Presently, more importance is being given to minimize the insecticidal resistance in insects.
Keeping this in view, the present study was planned to determine toxicity of new molecules with diversified mode of action against this pest in the laboratory to provide organised guidance for the selection of pesticides for management of the pest.

Materials and Methods
Present investigations on relative toxicity of different insecticides against aphid, *Aphis gossypii* infesting cumin were carried out under laboratory condition by using leaf dip method of bioassay against adult of aphid during 2019-2020 at Junagadh Agricultural University, Junagadh.

Relative toxicity of different insecticides against cumin aphid, *A. gossypii*
Relative toxicity of five insecticides (Table 1) was determined against the adult aphid. Five graded concentration (Table 1) for flonicamid, imidacloprid, dimethoate, flupyadifuron and difenthiurone were prepared from commercial formulation of the insecticides and used for this investigation. Bioassay was carried out by leaf dip method.

The untreated insect free twigs were plucked from field and then dipped into different insecticidal solution prepared for bioassay and then, dried the twigs for 10 minute. The treated twigs kept into the glass container, in which 10 adult insects were released. Simultaneously, twigs were dipped into distilled water serve as control.

Mortality was assessed after 24 hours of each treatment. Adults were considered as dead if it is unable to move in a coordinated manner when probed with a blunt needle otherwise considered as alive. Based on the data, per cent adult mortality was worked out and subjected to the corrected per cent mortality (Abbott, 1925) [1]. The statistical analysis was carried out as per probit analysis suggested by Finney, (1964) [7] and LC_{50} values for each insecticide were calculated. The toxicity ratio of insecticide was calculated by using the following formula.

$$P = \frac{P1 - C}{100 - C} \times 100$$

Where,

P = Corrected per cent mortality

P1 = Observed cent mortality in treatment C = Per cent mortality in control

$$\text{Toxicity ratio} = \frac{\text{LC50 of standard insecticide}}{\text{LC50 of candidate insecticide}}$$

Table 1: Different concentration of insecticides tested against cumin aphid, *A.gossypii* in laboratory condition.

Sr. No.	Insecticides	Concentrations
1.	Flonicamid 50 WG	0.00375
		0.0075
		0.015
		0.03
		0.06
2.	Imidacloprid 17.8 SL	0.0012
		0.0025
		0.005
		0.01
		0.02
3.	Flupyradifuron 17.09 EC	0.0075
		0.015
		0.03
		0.06
		0.12
4.	Dimethoate 30 EC	0.0075
		0.015
		0.03
		0.06
		0.12
5.	Difenthiurone 50 WP	0.012
		0.025
		0.05
		0.1
		0.2

Results and Discussion

In this study, the relative toxicity of different insecticides was evaluated by using the LC_{50} of dimethoate as unity, because this insecticide is usually recommended for the control of aphid. Five insecticides were tested against the adults of cumin aphis, *A. gossypii*.

It is recorded that imidacloprid was the most toxic and effective insecticides (LC_{50} = 0.00542) for cumin aphid. This insecticide was 7.675 times more toxic than dimethoate. However, flonicamid was slightly toxic than dimethoate. On other hand, difenthiuron found to be the least toxic in which the LC_{50} value was recorded as 0.1589.

Reported the LC_{50} value of different insecticides under test, they can be arranged in descending order as under:

Imidacloprid> flonicamid> dimethoate> flupyradifurone> difenthiuron

The effectiveness of each insecticide in comparison to dimethoate was also recorded. The results revealed that imidacloprid and flonicamid were 7.675 and 3.79 times more toxic than dimethoate, respectively. Whereas, Flupyradifuron and difenthiuron were 0.691 and 0.2617 times less toxic than dimethoate, respectively.

According to Patil *et al.* (2017) [8], the relative efficacy of imidacloprid (8.022) was highest in the leaf dip method followed by thiamethoxam (2.419) and against cowpea aphid, *A.craccivora.* Sahar (2019) tested the relative toxicity of different insecticide against cotton aphid, *Aphis gossypii*and found that flonicamid was the most toxic with LC_{50} value 0.58 mg/L. Mohammad *et al.* (2013) studied the toxicity of new insecticides against pomegranate aphid, *Aphis punicae* and reported the LC_{50} value for imidacloprid, Thiamethoxam, thiacloprid and flonicamid were calculated: 0.24 µl/ml, 0.31mg/ml, 0.48 µl/ml and 0.05 mg/ml, respectively. Probit analysis data revealed that the sensitivity of the insects to the pesticides was imidacloprid> thiacloprid> flonicamid> thiamethoxam

Table 2: Relative toxicity of different insecticides against cumin aphid, *A. gossypii*

Sr. No.	Insecticides	Heterogeneity		Regression equation	LC_{50}	Fiducial limits (L/U)	Relative toxicity
		χ^2	B				
1	Imidaclprid	1.039	1.442±0.159	Y=2.50+1.45x	0.00542	0.0108 0.0025	7.675
2	Flonicamid	0.027	1.29±0.0610	Y=1.29+1.81x	0.01096	0.01443 0.008327	3.55
3	Dimethoate	6.799	1.159±0.067	Y=1.96 +1.16x	0.0416	0.0564 0.03076	1
4	Flupyradifuron	0.01	0.8969±0.0276	Y=2.506 +0.8969x	0.0602	0.0682 0.05317	0.691
5	Difenthiuron	0.783	0.9338±0.2446	Y=2.022+0.93x	0.1589	0.4775 0.0524	0.2617

(N = 5, χ^2 table value = 7.81) Y= Probit kill
X= log (concentration x104)
LC_{50}= Concentration calculated to give 50 per cent mortality b= Regression co-efficient

Fig 1: Log concentration dosage response curve for Dimethoate

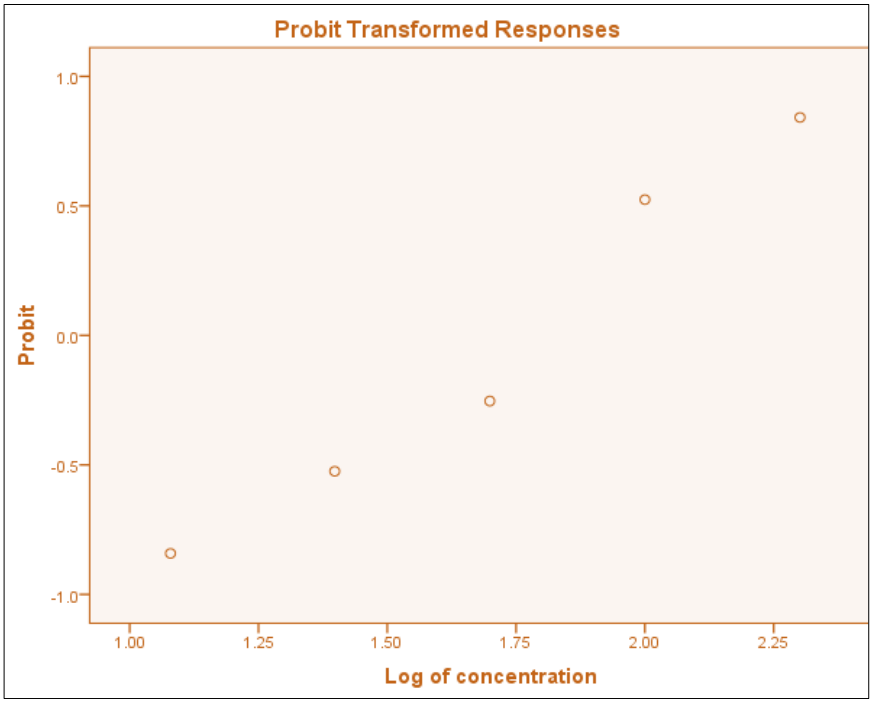

Fig 2: Log concentration dosage response curve for Imidacloprid

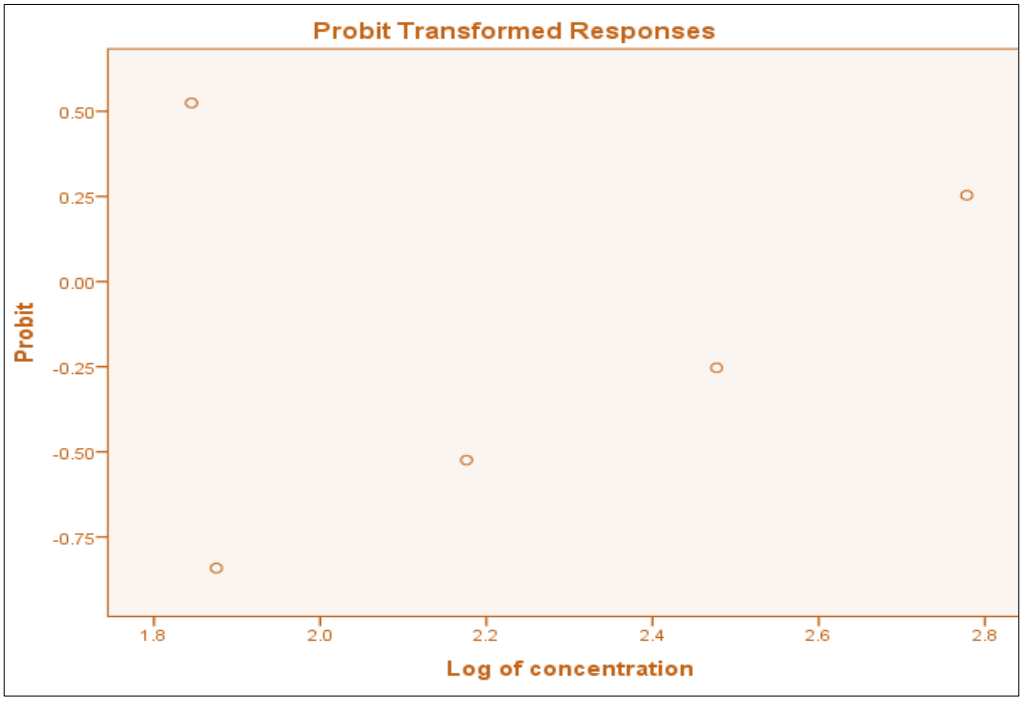

Fig 3: Log concentration dosage response curve for flupyradifuron

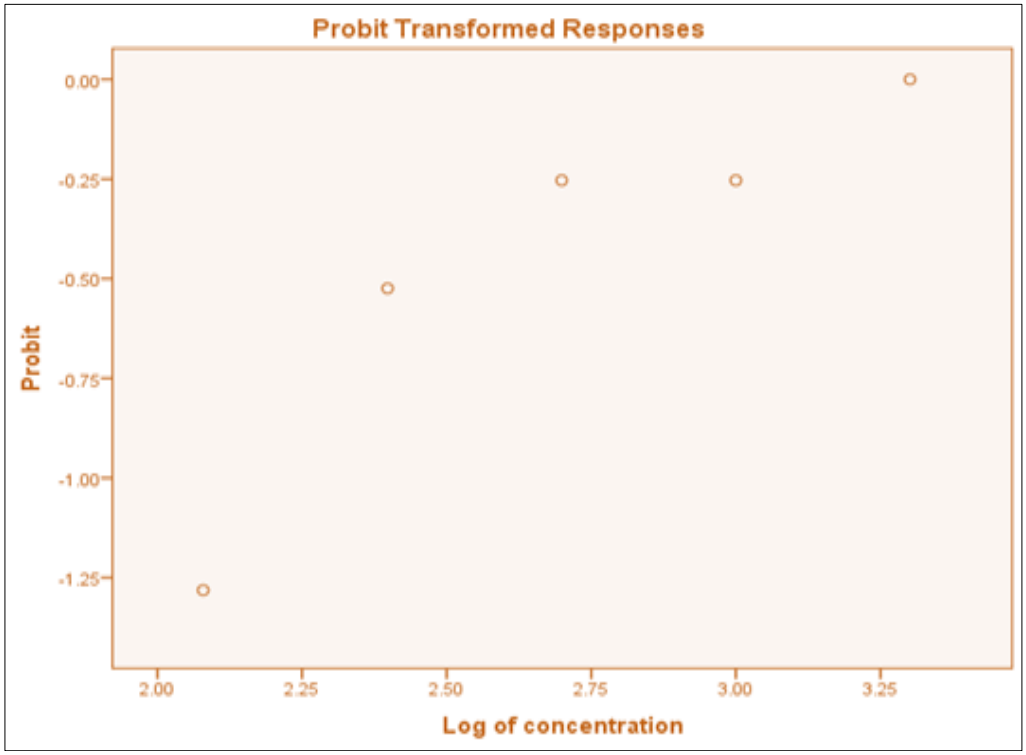

Fig 4: Log concentration dosage response curve for difenthiuron

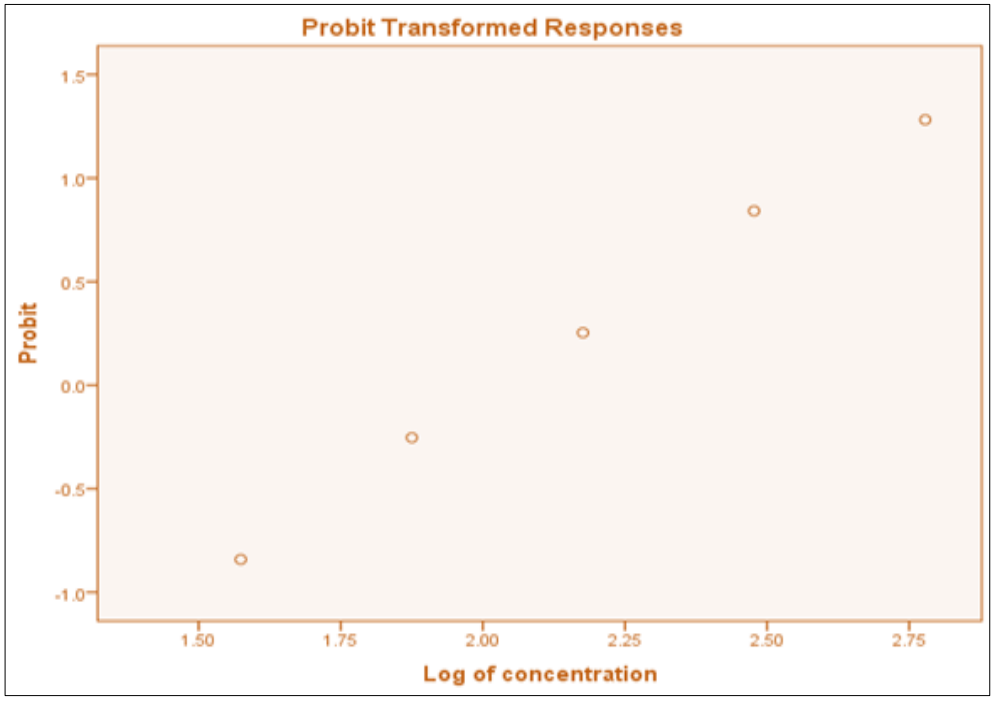

Fig 5: Log concentration dosage response curve for Flonicamid

Conclusion

The results of the relative toxicity of five selected insecticides showed that imidacloprid was the most toxic as its LC_{50} value 0.00542 per cent. On the other hand, difenthiuron was the less toxic insecticides (LC_{50}=0.1589).Reported the LC_{50} value of different insecticides under test, they can be arranged in descending order as under:

Imidacloprid>flonicamid>dimethoate > flupyradifurone > difenthiuron.

References

1. Abbott WS. A method of computing the effectiveness of an insecticides. Journal of Economics Entomology. 1925;18(4):42-43.
2. Aly A, Abd-Ella. Toxicity and persistence of selected neonicotinoid insecticides on cowpea aphid, *A. craccivora.* Archives of Phytopatho and Protection, 2013, 1-11.
3. Anonymous. Retrieved 12 1 2018, from spices wise area & production. Spices Board India. 2018a. http://indianspices.com/sites/default/file/spices_growing.pdf.
4. Anonymous. Retrieved 12 25, 2018, from Estimated export of spices from India, Spices board of India. 2018b. http://indianspices.com/sites/default/file/Monthaly_estimate_2018.pdf.
5. Dake RB, Bhamare VK, Mhaske SK. Bio-efficacy, persistence and residual toxicity of different insecticides against aphid, *Aphis gossypii* on sunflower. International Journal of Chemical Studies. 2019;7(3):3859-3863.
6. Dhole RR, Saindane YS, Deore BV, Patil SK. Relative toxicity of selected insecticides to cotton aphid, *A. gossypii*. Bulletin of Environment, Pharmacology and Life Sciences. 2017;6(3):392-395.
7. Finney DJ. Probit analysis, 2nd edition., Cambridge University Press, Cambridge, 1964, 318.
8. Patil S, Sridevi D, Babu RT, Pushpavathi B. Relative efficacy of selected insecticides on cowpea aphid, *A. craccivora*. Journal of Entomology and Zoology Studies. 2017;5(5):1603-1607.
9. Pawar MA, Patil CS. Relative toxicity of imidacloprid to *A. gossypii* and *A. biguttulabiguttula* infesting okra. Journal of Entomology and Zoology Studies. 2018;6(1):918-923.
10. Ramana N, Bandral RS, Zahid AW. Relative toxicity of some newer insecticides against mustard aphid on *Gobhi sarson*. International Journal of Current Microbiology and Applied Sciences. 2018;7(11):481-489.