International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2022; 10(1): 112-116

Received: 10-01-2022
Accepted: 12-02-2022

Vadher PU
Department of Entomology
College of Agriculture, JAU,
Junagadh, Gujarat, India

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

Gami PS
Department of Entomology
College of Agriculture, JAU,
Junagadh, Gujarat, India

Corresponding Author:
Vadher PU
Department of Entomology
College of Agriculture, JAU,
Junagadh, Gujarat, India

Persistence toxicity of some insecticides against cumin aphid, *Aphis gossypii* (Glover)

Vadher PU, Acharya MF and Gami PS

Abstract
The persistent toxicity of different insecticides were studied against third instar nymph of cumin aphid, *A. gossypii* under laboratory conditions in *rabi* 2019- 2020 by releasing them on the leaves/twigs collected from treatment wise field efficacy trial at Junagadh agricultural university, Junagadh. Persistence toxicity of flonicamid 0.015 per cent, imidacloprid 0.005 per cent and acetamiprid 0.008 per cent showed longer persistent upto 12 to 14 days. The order of the persistence of toxicity on the basis of RPT values was as flonicamid > imidacloprid > dimethoate > clothianidin > acetamiprid > thiamethoxam > flupyradifurone > spinetoram > difenthiuron.

Keywords: Cumin, persistence toxicity, aphid, *A. gossypii*

1. Introduction
Cumin (*Cuminum cyminum* Linnaeus) locally known as „Jeera‟ or „Jeru‟ belongs to family Umbelliferae. It is an indispensable condiment generally used in preparation of almost all the types of diets. Cumin oil is used in perfumery, flavouring liquors and in pleasants. It isa good medicine for digestive and intestinal upsets and used in veterinary medicine (Aiyer and Narayan, 1950) [2]. India is the leading producer (70% of world production), consumer and exporter of cumin in the world. Almost 80% of the crop cultivated is consumed in India (Anon., 2012). 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. Owing to the high rate of reproduction of this pest and continous disapping of the flowers; the grain formation is very much reduced. In case of severely infested umbels, the fruits were not set all or poorly developed which fail to add flavor in vegetable preparation and other consumable products.
The regular and frequent application of chemical insecticides is quite effective but creates a lot of problems viz., pest resurgence, secondary pest outbreak, development of resistance, increase the cost of cultivation and residual toxicity in soil. In recent years, selective insecticides were introduced into the market instead of traditional insecticides. Because of the resistance development to conventional insecticides and the introduction of selective insecticides into the market, the present study is aimed to assess the effect of some insecticides against aphid under field and laboratory conditions.

2. Materials and Methods
The persistent toxicity of different insecticides were studied against third instar nymph of cumin aphid, *A. gossypii* under laboratory conditions by releasing them on the leaves/twigs collected from treatment wise field efficacy trial in 2019- 2020 at Junagadh agricultural university, Junagadh.

2.1 Method of recording observations

With view to determine the residual or persistence toxicity of different insecticides like against cumin aphid, the twigs were plucked from different sprayed plots at 1, 4, 6, 8, 10, 12 and 14 days after spray, separately in the labeled polythene bags and brought to laboratory. The treated twigs were kept in glass containers, which are prepared separately for each treatment. Ten third instar nymphs were released with the help of moist camel hairbrush in glass container on treated twig and covered with muslin cloth. Each treatment was replicated three times and untreated twigs served as control. Observation on mortality count was recorded 24 hours after the releasing of the aphids and was continued till no mortality was observed. Moribund insects were considered as dead. Mortality was corrected by Abbott's (1925) [1] formula. The persistence or residual toxicity was determined as per the method elaborated by Pradhan and Venkatraman (1962). The product (PT) of average residual toxicity [T] and the period [P] for which the residual toxicity was studied served as an index of persistent toxicity.

Abbott's formula

$$\text{Per cent control or corrected percentage mortality} = \frac{100 - Y}{X - Y} \times 100$$

Where,

X - Mortality in treated plots Y - Mortality in control plots

$$\text{Average residual toxicity } T = \frac{\text{Total of corrected mortality at different intervals}}{\text{Number of observations}}$$

PT hr. = No. of period of which mortality observed (P) x Average residual toxicity (T)

$$\text{Relative persistence toxicity} = \frac{\text{Persistence toxicity of standard insecticide}}{\text{Persistence toxicity of candidate insecticide}}$$

3. Results and Discussion

A field cum laboratory study was carried out to assess the persistence toxicity of different insecticides against cumin aphid. The mortality data obtained at different intervals are included in Table.

3.1 Two days after spray

The mortality data observed that flonicamid 0.015 per cent gave significantly the highest mortality of *A. gossypii* with 97.50 per cent and it was found to be statistically at par with the imidacloprid 0.005 per cent and dimethoate 0.03 per cent as they had registered 94.79 and 94.79 per cent mortality values, respectively. The treatment acetamiprid 0.008 per cent, thiamethoxam 0.01 per cent, clothianidin 0.025 per cent, flupyradifuron 0.03 per cent and spinetoram 0.01 per cent registered 87.07, 85.18, 79.64, 77.44 and 66.66per cent mortality values, respectively. The lowest mortality was observed in the treatment of difenthiuron 0.0500 per cent which registered 62.96 per cent.

3.2 Four days after spray

The mortality data after four days of treatment recorded that flonicamid 0.015 per cent gave significantly the highest mortality of *A. gossypii* with 85.18 per cent and it was found to be statistically at par with the imidacloprid 0.005 per cent, dimethoate 0.03 per cent, acetamiprid 0.008 per cent, thiamethoxam 0.01per cent and clothianidin 0.025 per cent as they had registered 81.47, 81.47, 77.77, 77.77 and 79.64 per cent mortality values, respectively. The treatment flupyradifuron 0.03 per cent and spinetoram 0.01 per cent registered 70.36 and 66.66 per cent mortality values, respectively. The lowest mortality was observed in the treatment of difenthiuron 0.0500 per cent which registered 59.25per cent.

3.3 Six days after spray

The mortality data revealed after six day of spraying that flonicamid 0.015 per cent gave significantly the highest mortality of *A. gossypii* with 82.41 per cent and it was found to be statistically at par with the imidacloprid 0.005 per cent and dimethoate 0.03 per centas they had registered 77.82 and 70.76 per cent mortality values, respectively. The treatment acetamiprid 0.008 per cent, thiamethoxam 0.01 per cent, clothianidin 0.025 per cent and flupyradifuron 0.03 per cent registered 64.28, 60.87, 57.20 and 48.14mortality values, respectively.

Table 1: Persistence toxicity of different insecticide against cumin aphid, *A. gossypii*

Treatments	Corrected per cent mortality of aphidat different intervals after spray (Days)							P	T	PT	RPT	ORE
	2	4	6	8	10	12	14					
Imidacloprid 17.8 SL, 0.005%	81.92 (94.79)	64.75 (81.47)	61.99 (77.92)	43.93 (48.14)	30.89 (26.41)	23.97 (16.53)	22.06 (14.10)	14	51.33	718.62	1.10	2
Dimethoate 30 EC, 0.03%	81.92 (94.79)	64.75 (81.47)	57.36 (70.76)	43.93 (48.14)	23.97 (16.53)	18.43 (10.00)	10.15 (3.17)	12	54.14	649.68	1.00	3
Acetamiprid 20 SP, 0.008%	69.09 (87.07)	62.37 (77.77)	53.34 (64.28)	37.44 (37.03)	28.74 (23.17)	13.56 (5.50)	13.56 (5.50)	14	42.90	600.6	0.921	5
Clothianidin 50 WDG, 0.025%	64.58 (79.64)	59.99 (74.07)	49.14 (57.20)	33.61 (30.71)	22.06 (14.10)	10.15 (3.17)	-	12	51.77	621.24	0.953	4
Flupyradifurone 17.09 EC, 0.03%	62.17 (77.44)	57.11 (70.36)	43.93 (48.14)	27.62 (22.22)	13.56 (5.50)	-	-	10	44.73	447.3	0.6863	7
Spinetoram 11.7 SC 0.01%	54.93 (66.66)	54.93 (66.66)	35.06 (33.33)	13.56 (5.50)	9.1 (2.50)	-	-	10	43.66	436.6	0.669	8
Difenthiuron 50WP, 0.05%	52.55 (62.96)	50.37 (59.25)	35.06 (33.33)	13.56 (5.50)	-	-	-	8	40.26	322.08	0.494	9
Flonicamid 50 WG, 0.015%	89.7 (97.50)	67.64 (85.18)	65.44 (82.41)	52.55 (62.96)	33.32 (30.36)	26.11 (19.41)	23.97 (16.53)	14	56.33	788.62	1.21	1
Thiamethoxam 25 WG, 0.01%	67.64 (85.18)	62.37 (77.77)	51.31 (60.87)	33.61 (30.71)	23.97 (16.53)	13.56 (5.50)	9.1 (2.50)	12	46.51	558.12	0.859	6
C. D. at 5%	12.78	9.95	9.37	6.68	3.12	1.78	1.260					
C. V. %	10.78	9.59	10.87	11.69	8.83	8.85	8.39					
S.Em.±	4.30	3.34	3.15	2.249	1.05	0.600	0.424					

Figures in the parenthesis are retransformed values, those outside are arcsine values Dimethoate was taken as unity P = Period of time T = Average toxicity of the insecticides PT = Persistent toxicity RPT = Relative persistent toxicity ORE=Order of relative efficacy.

3.4 Eight days after spray

The flonicamid 0.015 per cent was significantly found to be the most effective treatment and gave 62.96 per cent mortality. The next best effective treatment imidacloprid 0.005 per cent, dimethoate 0.03 per cent, acetamiprid 0.008 per cent, thiamethoxam 0.01 per cent and clothianidin 0.025 per cent, and flupyradifuron 0.03 per cent and recorded 48.14, 48.14,37.03,30.71, 30.71 and 22.22 per cent mortality. The lowest mortality was observed in the treatment of spinetoram 0.01 per cent and difenthiuron 0.0500 per cent which registered 5.5 per cent.

3.5 Ten days after spray

The mortality data recorded after ten days of spraying that flonicamid 0.015 per cent gave significantly the highest mortality of *A. gossypii* with 30.36 per cent and it was found to be statistically at par with the imidacloprid 0.005 per centas they had registered 26.41 per cent mortality values, respectively. The treatment dimethoate 0.03 per cent, acetamiprid 0.008 per cent, thiamethoxam 0.01 per cent, clothianidin 0.025 per cent and flupyradifuron 0.03 per cent registered 16.53, 23.17, 16.53, 14.10 and 5.50 per cent mortality values respectively.

The mortality data also revealed that spinetoram 0.01 per cent and difenthiuron 0.05per cent was found the least persistent as it did not show mortality of the pest at ten days after application.

The *A. gossypii* mortality recorded at different intervals after the application, clearly indicated that there was a continuous decline in the effectiveness of various insecticides as the exposure of the insecticides was prolonged.

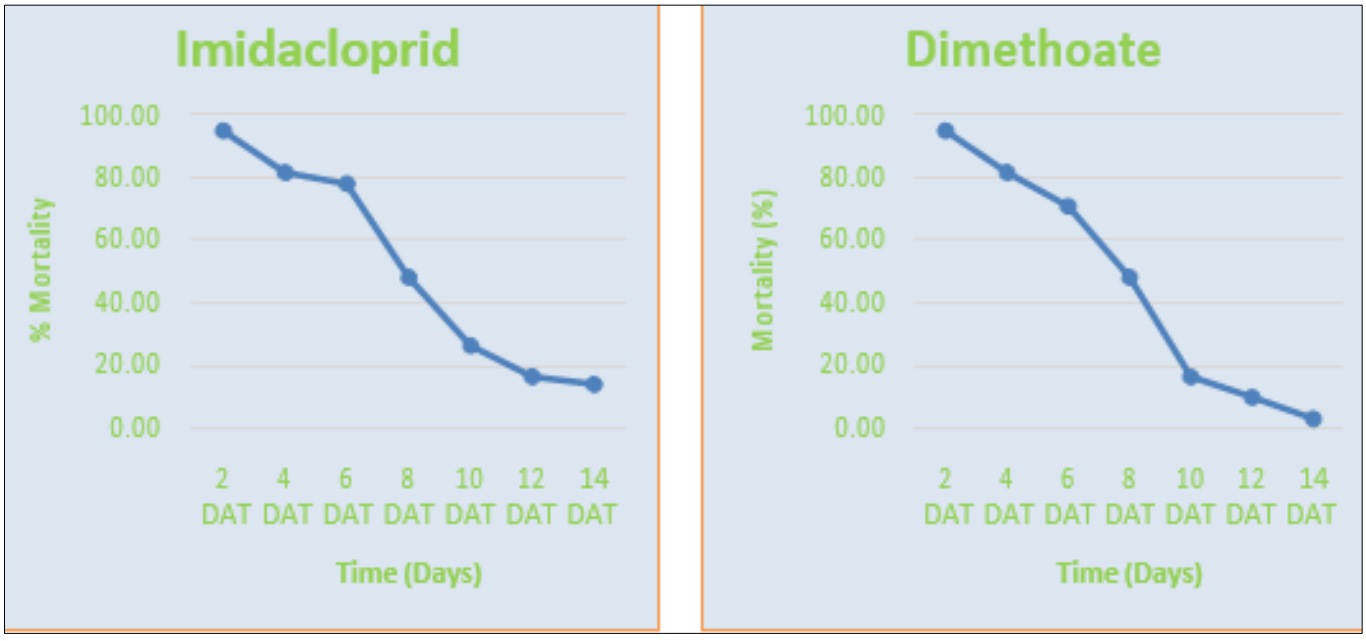
Finally, the relative persistence of the toxicity (RPT) was also worked out based on the PT index and it was taken as a criteria on for the relative persistence of toxicity. Considering the RPT values, it can be seen that flonicamid 0.015 per cent (1.22 times) and imidacloprid 0.005 per cent (1.11 times) were comparatively more effective in controlling the *A. gossypii* population than dimethoate under test, both in respect of mortality as well as their prolonged persistence. Taking the RPT values into consideration, they can be arranged in descending order as follows: flonicamid (1.21) >imidacloprid (1.10) >dimethoate (1.00)>clothianidin (0.953)> Acetamiprid (0.921)> thiamethoxam (0.859) >flupyradifurone (0.686) >spinetoram (0.669) >difenthiuron (0.494).

These findings are more or less in confirmation with the earlier research work done by Nikam (2017) revealed that Persistent toxicity of different insecticides based on RPT values, order as fellow: flonicamid> clothianidin> imidacloprid>acetamiprid>difenthiuron. Patil *et al*. (2018) [8] reported the persistent toxicity of seven different insecticides on cowpea aphid, *A. craccivora*. Highest persistence was shown by the imidacloprid (19 and 20 days) followed by acetamiprid>dimethoate>thiamethoxam>diafenthiuron (9 days and 10 days) at 24 and 48 hours of exposure, respective

4. Summary and Conclusion

Nine insecticides were tested for their persistent toxicity against cumin aphid, *A.gossypii*. All the insecticides under test gave upto 4 days and then the effect was decreased with an increase of time. However, flonicamid 0.015 per cent, imidacloprid0.005 per cent and acetamiprid 0.008 per cent showed longer persistence upto 14 to 12 days. The order of the persistence of toxicity based on RPT values was as under:

Flonicamid (1.21) >imidacloprid (1.10) >dimethoate (1.00) >clothianidin (0.953)>acetamiprid (0.921) > thiamethoxam (0.859) >flupyradifurone (0.686) >spinetoram (0.669) >difenthiuron (0.494).



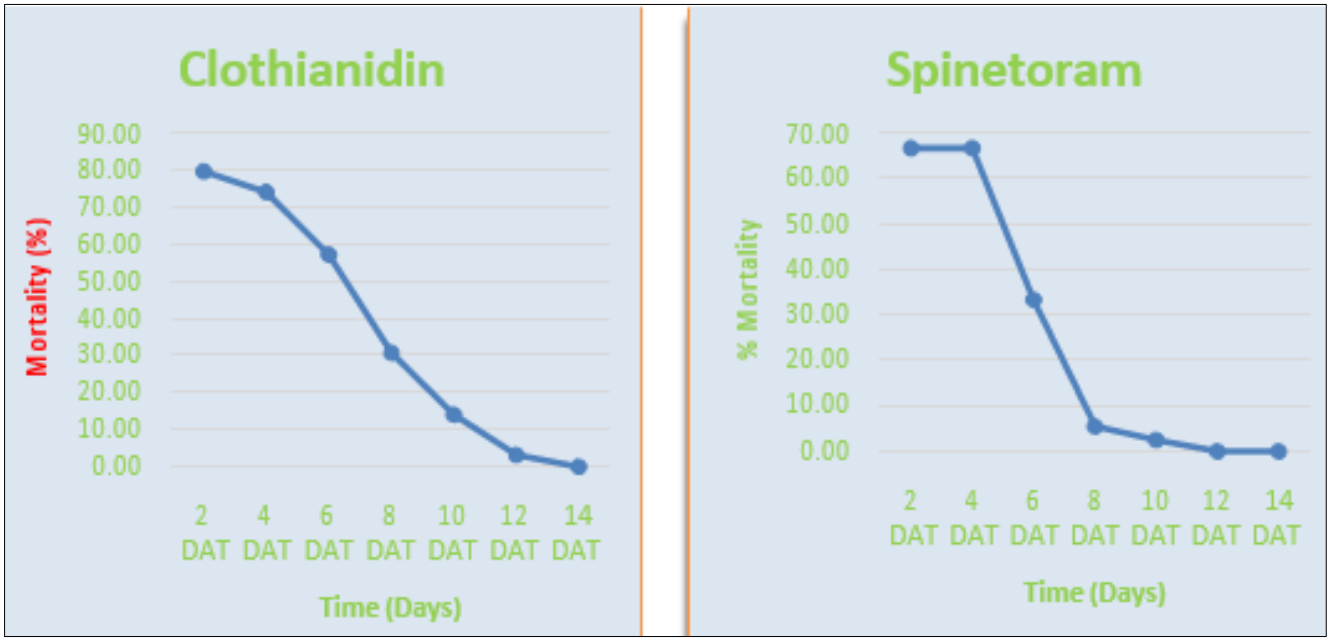
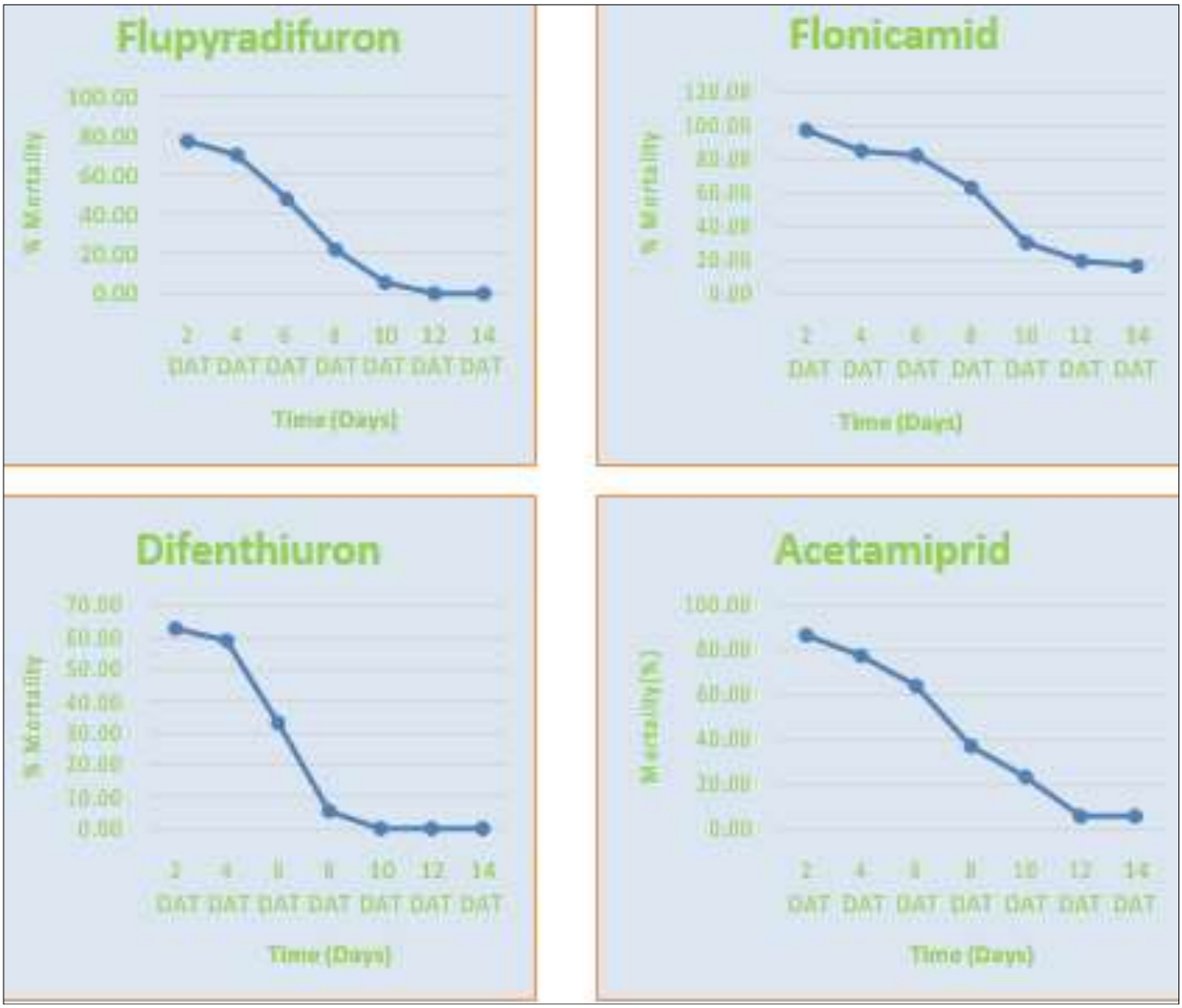


Fig 1: Persistence toxicity on terms of mortality of different insecticides in cumin



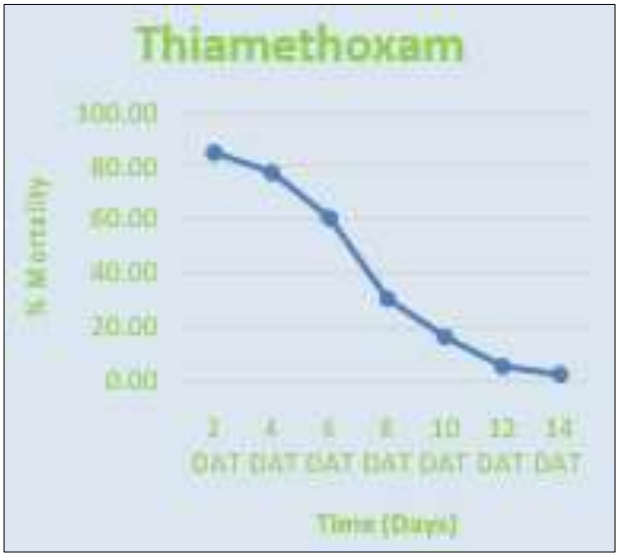


Fig 2: Persistence toxicity on terms of mortality of different insecticides in cumin

5. References

1. Abbott WS. A method of computing the effectiveness of an insecticides. Journal of Economics Entomology. 1925;18(4):42-43.
2. Aiyer AK, Narayan Y. "Field crops of India" The Banglore printing and Publishing Co. Ltd. 1950, 315-317.
3. Anonymous. 2018a. http://indianspices.com/sites/default/file/spices_growing.pdf. Retrieved 12 1 from spices wise area & production. Spices Board India. 2018.
4. Anonymous. 2018b. http://indianspices.com/sites/default/file/Monthaly_estimate_2018.pdf.
5. Retrieved 12 25, 2018, from Estimated export of spices from India, Spices board of India.
6. 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.
7. Mohammad R, Mohammad AS, Hamzeh I, Mohammadi E. Toxicity of new insecticides against pomegranate aphid, A. punicae. International Research Journal of Applied and Basic Sciences. 2013;4(3):496-501.
8. Patil S, Sridevi D, Babu RT, Pushpavathi B. Persistent toxicity of selected insecticides on cowpea aphid, *A. craccivora*. International Journal of Chemical Studies. 2018;6(3):2236-2239.
9. Pradhan SK, Venkataraman SV. Integration of chemical and biochemical of *Chillo zonellus* (Swin). The stalk borer of maize and jowar. Proceedings symposium on advanced frontiers of life science. Bulletin of the National Institute of Agriculture Science. 1965;19:119-125.
10. Preetha G, Monoharam T, Stanley J, Kuttalam S. Persistent toxicity of imidacloprid 17.8SL to aphid *Aphis gossypii* (Glover) and leaf hopper, *Amrasca biguttula* Ishida in bhindi. *Pest* Management in Horticultural Ecosystems. 2009;15(2):121-125.