Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-6: 281-288

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-6 pp. 281-288**
Journal homepage: http://www.ijcmas.com

Original Research Article

Management of Major Insect-Pests of Groundnut through Some Newer Insecticides

D.S. Mutkule*, P.B. Patil and N.E. Jayewar

Oilseeds research Station, Latur-413 512, Maharashtra, India
**Corresponding author*

A B S T R A C T

Investigations on Bio-efficacy of insecticides against insect-pests were carried out at Oilseeds Research Station, Latur, Maharashtra during *kharif*, 2016. Bio-efficacy of insecticides indicated chlorpyriphos 0.04 per cent established its superiority by imparting lowest population of *Helicoverpa armigera* and *Spodoptera litura* larvae. Whereas, for the suppression of leaf hopper and thrips the treatment of Imidacloprid 0.0036 per cent found most effective was followed by thiamethoxam 0.005 per cent which showed at par results with each other. Highest pod yield was recorded with the treatment of Imidacloprid 0.0036 per cent (1850 q/ha) followed by quinalphos 0.007 per cent (1815 q/ha) and thiamethoxam 0.005 per cent (1625 q/ha).

Keywords

Management, Groundnut, Insecticides, Insect-pests

Introduction

Groundnut (*Arachis hypogaea* L.) is a leading oilseed crop in India and an important oilseed crop of tropical and sub-tropical region of the world. In India during 2015 groundnut crop was grown on 37.054 lakh hectares area with 57.289 lakh tons of production and 1546 kg per hectare productivity. In Maharashtra, the area under groundnut cultivation was 1.86lakh hectare with production of 1.89 lakh metric tons and productivity comprises 1016 kg per hectare (Annual groundnut report, 2015).

Among the several factor responsible for low productivity in groundnut, the biggest threat to groundnut cultivation is the vulnerable and wide spread attacking by insect pests is major one. The important insect pests causing damage to the crop are leaf miner (*Aproaerema modicella* Deventer), Tobacco caterpillar (*Spodoptera litura* Fab), aphid (*Aphis craccivora* Koch), thrips [*Thrips palmi* Karni, *Scirtothrips dorsalis* H., *Caliothrips indicus*], jassids (*Empoasca kerri* Pruthi) and white flies (*Bemisia tabaci*). The extent of losses incurred by various insect-pests *viz*., leaf miner, tobacco leaf eating caterpillar, aphids, thrips and jassids were 24 to 92, 13 to 71, 16 to 42, 17 to 40 and 9 to 22 per cent, respectively in groundnut (Amin, 1987). The avoidable yield loss due to major insect-pests of groundnut was recorded to the tune of 48.57 per cent in pod and 42.11 per cent in fodder (Dabhade *et al.*, 2012). Various methods have been tried for the control of insect-pests but use of chemical method is an important approach for their control because of its quick action, effectiveness and adaptability to various situations.

Several insecticides have been recommended and used for the effective management of groundnut insect-pests. But according to several reports many of these label claimed insecticides could not achieved effective results. Hence these label claimed insecticides with some new insecticides were evaluated against insect pests of groundnut.

Materials and Methods

Present investigation was carried out to study the bio-efficacy of different insecticides against major insect-pests of groundnut at Department of Agricultural Entomology, Oilseeds research station, Latur (MS)-India during *kharif* 2016. The field experiment with groundnut crop using variety LGN-1 in *kharif* 2016 was conducted at the Research Farm of Department of Agriculture Entomology, Oilseeds Research Station, Latur (MS), India. The experiment was conducted in a randomized block design with seven treatments including untreated control replicated three times. The groundnut crop was sown on 21th June, 2016 in a gross plot of 5 x 4.2 sq m maintaining net plot of 4.8 x 3.6sq m. The row to row distance of 30 cm and plant to plant distance of 10 cm were maintained.

The insecticides treatments were Imidacloprid 17.8 SL @ 0.0036%, Thiamethoxam 25 WG @ 0.005, Quinalphos 25 EC @ 0.007 %, Lambda-cyhalothrin 5 EC @ 0.0025%, Chlorpyriphos 20 EC 0.04% and Deltamethrin 2.8 EC @ 0.0028%. The application of treatment was done when the pest crossed ETL level. Five observation plants were selected randomly from the net plot of each treatment in each replication. The observations of *Helicoverpa armigera* and *Spodoptera litura* larvae were recorded on five randomly selected plants from net plot at one day before and 1, 3, 7, 10 and 14 days after application of insecticides. The observations on total number of leaf hopper and thrips were recorded on top, middle and bottom trifoliate leaves of five randomly selected plants from each treatment at one day before treatment and 1, 3, 7, 10 and 14 days after application of insecticides. The data on number of *Helicoverpa armigera*, *Spodoptera litura*, leaf hopper and thrips were transformed into square root transformation and statistical analyzed. After crop attained maturity, net plot was harvested, pod were separated in each treatment. The weight of pod per plot was recorded after drying. Plot wise yield was computed on hectare basis for statistical interpretation. The data was analysed as per the procedure of Gomez and Gomez (1984).

Results and Discussion

Effect of different insecticides on larval population of *Helicoverpa armigera* and *Spodoptera litura*

The results revealed that the plots treated with chlorpyriphos 0.04 per cent recorded significantly lowest larval population of *Helicoverpa armigera* and *Spodoptera litura* larvae per plant at 1, 3, 7, 10 and 14 days after spraying, respectively over rest of the insecticides. At one day after spray, significantly minimum larval population of *Helicoverpa armigera* and *Spodoptera litura* was registered from the plots treated with chlorpyriphos 0.04 per cent. The subsequent order of effectiveness was lambda-cyhalothrin 0.0025 per cent and quinalphos 0.007 per cent. At three, seven, ten and fourteen days after spray the treatment of chlorpyriphos 0.04 per cent and lambda-cyhalothrin 0.0025 per cent registered significantly lowest larval population of *Helicoverpa armigera* and *Spodoptera litura* (Table 1 and 2).

Earlier, Chauhaan *et al.,* (2015) stated that chlorpyriphos 20 per cent EC found more effective against *Helicoverpa armigera*. The significance efficacy of treatment lambda-cyhalothrin 5 EC was also effective for the reduction of *Helicoverpa armigera* population (Duraimurugan *et al.,* 2007). Similar result of efficacy of cholrpyriphos against *Spodoptera litura* are reported by Harish *et al.,* (2009), Chauhan *et al.,* (2015) and Bhadane *et al.,* (2016) stated that chlorpyriphos was found most effective treatment against *Spodoptera litura*. The significance of efficacy of trearment quinalphos and chlorpyriphos was also proved as an effective against *Spodoptera litura* (Chandrayadu *et al.,* 2015 and Bhadane *et al.,* 2016).

Effect of different insecticides on population of groundnut leaf hopper, *Empoasca kerri*

The plots treated with imidacloprid 0.0036 per cent recorded significantly lowest population of leaf hopper on groundnut to the extent of 0.40, 0.53, 0.67, 0.80 and 1.00 per trifoliate leaves at 1, 3, 7, 10 and 14 days after spraying, respectively over rest of the insecticides. At one day after spray, significantly minimum population of leaf hopper (0.40 per trifoliate leaves) was recorded from the plots treated with imidacloprid 0.0036 per cent followed by thiamethoxam 0.005 per cent (0.53 leaf hopper per trifoliate leaves) which were found significantly superior and statistically at par with each other. The next effective treatments were lambda-cyhalothrin 0.0025 per cent (1.13 leaf hopper per trifoliate leaves) and deltamethrin 0.0028 per cent (1.20 leaf hopper per trifoliate leaves) were also statistically superior with each other. Subsequently effective treatments were quinalphos 0.007 per cent (2.13 leaf hopper per trifoliate leaves) and chlorpyriphos 0.04 per cent (2.27 leaf hopper per trifoliate leaves). Similarly, at three, seven, ten and fourteen days after spray, imidacloprid 0.0036 per cent recorded significantly lowest population of leaf hopper followed by thiamethoxam 0.005 per cent (Table 3).

The trend of results found in the present investigation coincides with Babu and Santharam (2002) who reported imidacloprid @ 100, 150, 200 and 250 ml/ha superior to the standard chemicals in reducing leaf hopper population up to three weeks in groundnut. Similarly, Bhadane *et al.,* (2007) recorded imidacloprid 200 SL significantly effective in reducing the nymphal population of groundnut leaf hopper at three days after spray. Zadda *et al.,* (2015) who reported that imidachloprid 200 SL was effective insecticide for suppressing leaf hopper population on groundnut.

Effect of different insecticides on population of thrips (*Scirtothrips dorsalis* Hood) infesting groundnut

The results revealed that (Table 4) all the insecticides were found to be significantly superior over untreated control in reducing the population of groundnut thrips at 1, 3, 7, 10 and 14 days after application of insecticides.

At one day after spray, imidacloprid 0.0036 per cent recorded significantly lowest population of thrips to the tune of 0.53 per trifoliate leaves followed by thiamethoxam 0.005 per cent (0.60 thrips per trifoliate leaves). All these two treatments were found statistically at par with each other. Lambda-cyhalothrin 0.0025 per cent (1.47 thrips per trifoliate leaves) and deltamethrin 0.0028 per cent (1.53 thrips per trifoliate leaves) were recorded next best treatments, and which were statistically at par with each

other. The next effective treatments were quinalphos 0.007 per cent (2.43 thrips per trifoliate leaves) and chlorpyriphos 0.04 per cent (2.67 thrips per trifoliate leaves). At three days after spray, significantly minimum population of thrips (0.57 per trifoliate leaves) was recorded from the plots treated with imidacloprid 0.0036 per cent, followed by thiamethoxam 0.005 per cent (0.64 thrips per trifoliate leaves).

These two insecticides were found statistically at par with each other. The next efficient treatments in minimizing thrips population were lambda-cyhalothrin 0.0025 per cent (1.57 thrips per trifoliate leaves) and deltamethrin 0.0028 per cent (1.63 thrips per trifoliate leaves), and these two treatments were statistically at par with each other. After these treatments Quinalphos 0.007 per cent (2.57 thrips per trifoliate leaves) and chlorpyriphos 0.04 per cent (2.70 thrips per trifoliate leaves) are also effective treatments for minimizing the population of thrips.

At seven days after spray, lowest thrips population (0.67 per trifoliate leaves) was recorded from the plots treated with imidacloprid 0.0036 per cent, followed by thiamethoxam 0.005 per cent (0.87 thrips per trifoliate leaves). These two insecticides were recorded statistically at par with each other. The next efficient treatments in minimizing thrips population were lambda-cyhalothrin 0.0025 per cent (1.73 thrips per trifoliate leaves) and deltamethrin 0.0028 per cent (1.80 thrips per trifoliate leaves), and these two treatments were found statistically at par with each other. After these treatments Quinalphos 0.007 per cent (2.87 thrips per trifoliate leaves) and chlorpyriphos 0.04 per cent (3 thrips per trifoliate leaves) are also effective treatments for minimizing the population of thrips.

At 10 days after spray, imidacloprid 0.0036 per cent observed significantly minimum population of thrips (0.87 per trifoliate leaves) which was followed by thiamethoxam 0.005 per cent (1.07 thrips per trifoliate leaves) and these two insecticides were found statistically at par with each other. The next effective treatments were lambda-cyhalothrin 0.0025 per cent (1.93 thrips per trifoliate leaves) and deltamethrin 0.0028 per cent (2 thrips per trifoliate leaves). And these two treatments are statistically at par with each other. Quinalphos 0.007 per cent (3.07 thrips per trifoliate leaves) and chlorpyriphos 0.04 per cent (3.13 thrips per trifoliate leaves) were also effective for minimizing the population of thrips.

At 14 days after spray, the lowest population of thrips was recorded from imidacloprid 0.0036 per cent (1.20 per trifoliate leaves), followed by thiamethoxam 0.005 per cent (1.30 thrips per trifoliate leaves). Both of these treatments were found at par with each other. The next effective treatments were lambda-cyhalothrin 0.0025 per cent (2.27 thrips per trifoliate leaves) and deltamethrin 0.0028 per cent (2.27 thrips per trifoliate leaves) and these two treatments are statistically at par with each other. After these quinalphos 0.007 per cent (3.27 thrips per trifoliate leaves) and chlorpyriphos 0.04 (3.53 thrips per trifoliate leaves) were also effective for minimizing the population of thrips. The result on the effectiveness of imidacloprid against thrips infesting groundnut in the present investigation is in accordance with Venkanna (2003) who noted two sprays of imidacloprid 0.00534 per cent at 25 and 40 days after sowing effective in reducing the thrips population. Similarly, Bhadane *et al.,* (2007) and Rathod *et al.,* (2010) documented imidacloprid 200 SL as the most effective treatment in minimizing thrips population. Venkanna *et*

al., (2010) found imidacloprid at the rate of 26.7 g a.i per hectare significantly effective treatment in reduced thrips population. Nataraja *et al.,* (2013) was found imidachloprid 17.8 SL and thaimethoxam 25 WG effective in reducing population of thrips. Zadda *et al.,* (2015) who reported that imidachloprid 200 SL was effective insecticide for suppressing thrips population on groundnut.

Effect of different insecticides of pod yield (Kg/ha)

The data regarding pod yield (Table 5) of groundnut revealed that all the treatments were statistically significant in increasing pod yield over untreated control. The pod yield of groundnut due to different treatments varied from 1017 to 1850 kg per hectare. The significantly highest pod yield (1850 kg per hectare) of groundnut was recorded in imidacloprid 0.003per cent which was followed by quinalphos 0.007 per cent (1815 kg per hectare), Thiamethoxam 0.005 per cent (1625 kg per hectare), Lambda-cyhalothrin 0.0025 per cent (1580 kg per hectare), Chlorpyriphos 0.04 per cent (1490 kg per hectare) and Deltamethrin 0.0028 per cent (1420 kg per hectare). However, the lowest pod yield (1017 kg per hectare) was registered in untreated control.

Table.1 Effect of different insecticides on the larval population of *Helicoverpa armigera* on groundnut

Treatments	Mean larval population of *Helicoverpa armigera* per plant					
	1 day before spraying	Days after spraying				
		1	3	7	10	14
Imidacloprid 0.0036 per cent	2.07 (1.59)*	0.73 (1.10)	0.80 (1.14)	0.93 (1.20)	1.27 (1.33)	1.60 (1.45)
Thiamethoxam 0.005 per cent	2.27 (1.66)	0.53 (1.01)	0.67 (1.08)	0.80 (1.14)	1.00 (1.22)	1.40 (1.38)
Quinalphos 0.007 per cent	2.33 (1.67)	0.20 (0.84)	0.53 (1.02)	0.73 (1.11)	0.93 (1.19)	1.27 (1.33)
Lambda-cyhalothrin 0.0025 per cent	3.27 (1.94)	0.13 (0.79)	0.20 (0.83)	0.33 (0.91)	0.47 (0.98)	0.73 (1.11)
Chlorpyriphos 0.04per cent	2.67 (1.77)	0.07 (0.75)	0.13 (0.79)	0.20 (0.84)	0.33 (0.91)	0.47 (0.98)
Deltamethrin 0.0028 per cent	2.53 (1.74)	0.60 (1.05)	0.73 (1.10)	0.87 (1.16)	1.07 (1.25)	1.47 (1.40)
Untreated Control	2.67 (1.78)	2.73 (1.80)	2.87 (1.83)	3.00 (1.86)	3.13 (1.90)	3.53 (2.00)
S.E. ±	0.09	0.05	0.05	0.06	0.06	0.06
C.D. at 5%	NS	0.16	0.16	0.18	0.18	0.19
C.V. (%)	8.83	8.90	8.12	8.91	8.10	7.77

*Figures in parentheses are square root transformed values ($\sqrt{x + 0.5}$)

Table.2 Effect of different insecticides on the larval population of *Spodoptera litura* on groundnut

Treatments	Mean population of *Spodoptera litura* per plant					
	1 day before spraying	Days after spraying				
		1	3	7	10	14
Imidacloprid 0.0036 per cent	1.00 (1.22)*	0.80 (1.14)	0.87 (1.17)	1.00 (1.21)	1.80 (1.52)	2.33 (1.68)
Thiamethoxam 0.005 per cent	1.67 (1.46)	0.73 (1.10)	0.80 (1.13)	0.87 (1.17)	1.40 (1.37)	1.80 (1.51)
Quinalphos 0.007 per cent	2.47 (1.72)	0.20 (0.84)	0.27 (0.87)	0.80 (1.14)	1.27 (1.33)	1.67 (1.47)
Lambda- cyhalothrin 0.0025 per cent	2.00 (1.58)	0.13 (0.79)	0.20 (0.84)	0.33 (0.91)	0.73 (1.11)	0.93 (1.20)
Chlorpyriphos 0.04per cent	2.07 (1.60)	0.07 (0.75)	0.13 (0.79)	0.27 (0.87)	0.40 (0.94)	0.73 (1.10)
Deltamethrin 0.0028 per cent	1.33 (1.34)	0.73 (1.11)	0.80 (1.13)	0.93 (1.20)	1.53 (1.42)	2.00 (1.58)
Untreated Control	1.87 (1.54)	2.07 (1.60)	2.27 (1.66)	2.87 (1.83)	3.13 (1.90)	3.87 (2.09)
S.E. ±	0.09	0.06	0.07	0.07	0.07	0.08
C.D. at 5%	NS	0.18	0.19	0.20	0.20	0.23
C.V. (%)	10.25	9.53	10.39	9.76	8.16	8.78

*Figures in parentheses are square root transformed values ($\sqrt{x + 0.5}$)

Table.3 Effect of different insecticides on the population of groundnut leaf hopper

Treatments	**Mean population of leaf hopper per trifoliate leaves**					
	1 day before spraying	**Days after spraying**				
		1	**3**	**7**	**10**	**14**
Imidacloprid 0.0036 per cent	6.00 (2.55)*	0.40 (0.94)	0.53 (1.02)	0.67 (1.07)	0.80 (1.14)	1.00 (1.22)
Thiamethoxam 0.005 per cent	5.87 (2.50)	0.53 (0.10)	0.67 (1.07)	0.73 (1.10)	0.87 (1.17)	1.20 (1.30)
Quinalphos 0.007 per cent	6.67 (2.68)	2.13 (1.61)	2.47 (1.72)	2.60 (1.76)	2.93 (1.85)	3.67 (2.04)
Lambda- cyhalothrin 0.0025 per cent	6.67 (2.66)	1.13 (1.27)	1.40 (1.38)	1.53 (1.42)	1.73 (1.49)	2.20 (1.64)
Chlorpyriphos 0.04per cent	6.67 (2.67)	2.27 (1.66)	2.73 (1.79)	2.80 (1.81)	3.00 (1.86)	3.87 (2.09)
Deltamethrin 0.0028 per cent	6.33 (2.58)	1.20 (1.30)	1.67 (1.47)	1.73 (1.49)	1.87 (1.53)	2.47 (1.71)
Untreated Control	6.00 (2.55)	6.13 (2.57)	6.27 (2.60)	6.67 (2.67)	6.87 (2.70)	8.07 (2.92)
S.E. ±	0.55	0.08	0.06	0.08	0.08	0.09
C.D. at 5%	NS	0.25	0.19	0.25	0.25	0.29
C.V. (%)	12.03	9.61	7.06	8.74	8.49	8.96

*Figures in parentheses are square root transformed values ($\sqrt{x + 0.5}$)

Table.4 Effect of different insecticides on the population of groundnut thrips

Treatments	Mean population of thrips per trifoliate leaves					
	1 day before spraying	Days after spraying				
		1	3	7	10	14
Imidacloprid 0.0036 per cent	7.87 (2.88)*	0.53 (1.01)	0.57 (1.02)	0.67 (1.07)	0.87 (1.16)	1.20 (1.29)
Thiamethoxam 0.005 per cent	8.00 (2.91)	0.60 (1.05)	0.64 (1.06)	0.87 (1.16)	1.07 (1.24)	1.33 (1.35)
Quinalphos 0.007 per cent	7.20 (2.77)	2.43 (1.71)	2.57 (1.75)	2.87 (1.83)	3.07 (1.89)	3.27 (1.94)
Lambda-cyhalothrin 0.0025 per cent	8.67 (2.99)	1.47 (1.40)	1.57 (1.43)	1.73 (1.49)	1.93 (1.55)	2.27 (1.64)
Chlorpyriphos 0.04per cent	8.00 (2.91)	2.67 (1.77)	2.70 (1.78)	3.00 (1.86)	3.13 (1.90)	3.53 (2.00)
Deltamethrin 0.0028 per cent	7.53 (2.83)	1.53 (1.43)	1.63 (1.46)	1.80 (1.51)	2.00 (1.57)	2.27 (1.65)
Untreated Control	7.53 (2.83)	7.60 (7.85)	7.87 (2.89)	7.93 (2.90)	8.47 (2.99)	8.60 (3.01)
S.E. ±	0.18	0.08	0.10	0.08	0.10	0.08
C.D. at 5%	NS	0.25	0.30	0.24	0.30	0.27
C.V. (%)	10.72	8.93	10.62	8.21	9.87	7.95

*Figures in parentheses are square root transformed values ($\sqrt{x + 0.5}$)

Table.5 Effect of different insecticides of pod yield (Kg/ha)

Treatments	Mean pod yield kg/ha
Imidacloprid 0.0036 per cent	1850
Thiamethoxam 0.005 per cent	1625
Quinalphos 0.007 per cent	1815
Lambda-cyhalothrin 0.0025 per cent	1580
Chlorpyriphos 0.04 per cent	1490
Deltamethrin 0.0028 per cent	1420
Untreated Control	1017

References

Amin, P.W. 1987. Insect-pests of groundnut in India and their management. *Lead papers of the national seminar on plant protection in field crops*, 29-31 January 1986, CPPTI: 219-231.

Annual groundnut report, 2015. All India coordinated research project on groundnut ICAR – directorate of groundnut research, Junagadh, Gujarat, India. 1-3.

Babu, Ramesh, K. and Santharam, G. 2002. Bioefficacy of imidacloprid against leaf hoppers, *Empoascakerri* on groundnut. *Ann. Pl. Prot. Sci.*, 10(1): 69-70.

Bhadane, R.S., Aghav, S.T., Sushir, M.A.,

Dharne, P.K. and Patil, A.J. 2007. Bio- efficacy of Confidor 200 SL (imidacloprid) against sucking pests on groundnut. *Asian J. Bio.Sci*., 2(1/2): 137-139.

Chandrayudu, E., Murali Krishna, T., John Sudheer, M., Sudhakar, P. and Vemana, K. 2015. Relative efficacy of insecticides against *Spodoptera litura* (Fab) in groundnut. *Ann. Pl. Protec. Sci*,. 23(2): 277-281.

Chauhan, D and Srivastava, R.P. 2015. Bioefficacy of three insecticides against tobacco caterpillar, *Spodoptera litura* (Fab.). *J. ent. Res*., 39(3): 243-247.

Dabhade, P.L., Bapodra, J.G., Jethava, D.M., Rathod, R.T. and Dabhi M.V. 2012. Estimation of yield losses due to major insect-pests of groundnut in Gujarat. *Legume Res.-An International J.*, 35(4): 354-356.

Duraimurugan, P., Suganykanna, S., Chandrasekaran, S. and Regupathy, A. 2007. Field evaluation of emamectin 5 SG against cotton bollworm, *Helicoverpa armigera* (Hub.). *Pesticide Res. J*., 19(2): 186-189.

Gomez, K. A., and A. A. Gomez, 1984. Stastical Procedure in Agricultural Research, U.S.A., A Willey Inter Science Pub. 299.

Harish, G., Patil, R.H. and Girddi, R.S. 2009. Evaluation of biorational pesticides against lepidopteran defoliators in soybean. *Karnataka J. Agric. Sci*., 22(4): 914-917.

Nataraj, M.V., Harish. G., Jasrotia. P., Holajjer. P., Savaliya. S.D. and Gajera. M. 2014. Neo-nicotinoids: A biorational approach for managing sucking insect-pests of groundnut. *Ann. Pl. protec. Sci*., 22(1): 42-48.

Rathod, P.K., Mane, P.N., Thakre, A.Y., De shmukh, S.N. and Barkhade, U.P. 201 0. Management of whitefly, *Bemisia tabaci* and thrips, *Scirtothrips dorsalis* in *rabi* sunflower with botanicals and chemicals. *Indian J. Pl. Prot.*, 38(2): 139-143.

Venkanna, Y. 2003. Bioefficacy of certain new insecticides against pest complex of groundnut. M.Sc. (Agri.) thesis submitted to Acharya N.G. Ranga Agriculture University, Hyderabad, AP, India (Unpublished).

Venkanna, Y., Rao, G.V. and Reddy, K. D. 2010. Bioefficacy of neonicotinoid ins cticides against thrips, *Scirtothrips dorsalis* and leaf hoppers, *Empoasca kerri* in groundnut. *Indian J. Pl. Prot.*, 38(2): 134-138.

Zadda, K. and C. Vijayraghavan. 2015. Evaluation of newer insecticides against sucking insects infesting rainfed groundnut. *Pestology* 9: 45-48.