INTERNATIONAL JOURNAL OF PLANT PROTECTION
VOLUME 9 | ISSUE 2 | OCTOBER, 2016 | 589-592

● e ISSN-0976-6855 | Visit us : *www.researchjournal.co.in*

IJPP

RESEARCH PAPER

DOI : 10.15740/HAS/IJPP/9.2/589-592

Detection of insecticidal resistance against various insect pests in vegetable crops at Raipur

■ ARVIND KUMAR AYAM, ARUN SAHU, CHANDRAMANI SAHU* AND V.K. KOSHTA

Department of Entomology, College of Agriculture, Indira Gandhi Agricultural University, RAIPUR (C.G.) INDIA

ARITCLE INFO

Received : 03.08.2016
Revised : 12.09.2016
Accepted : 26.09.2016

KEY WORDS :
Bioassay, LD_{50} value, Chlorpyriphos, Cypermethrin

*Corresponding author:
Email : chandrasahu2111@gmail.com

ABSTRACT

Bioassay methods such as leaf dip and larvae dip were used in the laboratory conditions for testing lethal dose of insect pests conducted at laboratory of department of entomology, IGKV, Raipur (C.G.) during 2009-2010. At least five dilutions for each of the selected insecticides were tested using different methods. In each method and insecticide at least 10 larvae of 2-3rd instars were released on each dilution in 3 replications along with untreated control. The results shown that the *Helicoverpa armigera* population was maximum LD_{50} value to Chlorpyriphos (O.633 µg/lit) followed by *Spodoptera litura* population LD_{50} (0.576 µg/lit) and lower value for *Leucinodes arbonalis* LD_{50} (0.503 µg/lit) and the *Plutella xylostella* population showed maximum LD_{50} value to Cypermethrin (0.810µg/lit) and lower LD_{50} value (0.246 µg/lit) for *Trichoplusia ni.* Therefore, *H. armigera* showed higher resistance to Chlorpyriphos and *P. xylostella* showed higher resistance towards Cypermethrin.

How to view point the article : Ayam, Arvind Kumar, Sahu, Arun, Sahu, Chandramani and Koshta, V.K. (2016). Detection of insecticidal resistance against various insect pests in vegetable crops at Raipur. *Internat. J. Plant Protec.*, **9**(2) : 589-592, **DOI : 10.15740/HAS/IJPP/9.2/589-592**.

INTRODUCTION

A large number of pesticides are being used for destroying, repelling or reducing a wide range of pests in agriculture, forestry and public health today. In-spite of vigorous efforts made by plant protection workers to popularize non- chemical methods to control pests, chemical methods still remains one of the most powerful tools for pest control particularly when other preventive measures fail (Parmar and Dureja, 1990). The use of chemicals in crop protection is a profit induced poisoning of the environment. The concentration of pesticide residues in air, soil, flora and fauna is continuously increasing day by day and in the near future it may reach the level of poisoning. Hence, it is important to study the behaviour of pesticides on plants and in soil. Pesticides come in contact with plants either from direct application or by uptake from soil. Degradation of pesticides may occur by chemical or biological process or by a combination of both. Important chemical reaction includes oxidation, reduction, hydrolysis and other

nuclear reactions. Other reactions include isomerisation, internal cyclisation and elimination (Alfred *et al*., 1982). Insecticides being the most economical and quick in action are most commonly used against Diamond Back Moth, *P. xylostella* world wide. This excessive and indiscriminate use of pesticides has only eliminated natural enemies but also the pest has developed resistance against major groups of commonly used insecticides throughout the world. Resistance ability against toxic agent is brought either by genetic selection or by direct exposure to the selecting agent or by cross-resistance resulting from selection by some other toxic agent. The development of resistance is thus depend on genetic variability already present in a population or arising during the period of selection (Oppenoorth, 1985). An approach of developing resistance against pesticides is neither desirable nor sustainable and there is a need to bring reduction in pesticides use (Roush, 1997). The accepted theory of pest management favoured the application of pesticides when insect pests population approach or exceed economic threshold which could lead to better and more effective way of pesticide use (Metcalf, 1980). Pyrethroids are fastest developing group of modern insecticides. They are replacing many other insecticides because of their great effectiveness and safety of application. The susceptibility of *H. armigera* to pyrethroids has been investigated in West Africa by means of laboratory bioassays since 1985, the first year of widespread pyrethroid use. For some years, survey has shown a tendency for the pest to become more tolerant to pyrethroids. During the 1996 growing season, farmers using calendar-based spraying programmes reported control failures in various countries (Martin *et al.*, 2000). The 144-folds resistance in Diamond Back Moth against cypermethrin was observed at Panipat (Haryana) in India (Saxena *et al.*, 1989) and these was 25 folds resistance in Diamond Back Moth to cypermethrin in India (Raju and Singh, 1995). The Diamond Back Moth resistance to cypermethrin was encountered in Punjab (Chawla and Joia, 1991). Objectives of this experiment to detection of insecticidal resistance against some insect pest in vegetables. Mostly two types of methods were used to testing resistance such as leaf dip bioassay and larvae dip bioassay along with the determination of LD_{50} value against Chlorpyriphos 20 per cent EC and Cypermethrin 10 per cent EC.

MATERIAL AND METHODS

The present investigation was conducted at laboratory of department of entomology, IGKV, Raipur (C.G.) during 2009-2010. For the determination of LD_{50} value, two type of insecticides were used such as Chlorpyriphos 20 per cent EC and Cypermethrin 10 per cent EC and different this experiments tested on the larvae of *Helicoverpa armigera* (Hubner), *Spodoptera litura* (Hubner), *Leucinodes arbonalis* (Guen.) and *Plutella xylostella* (L.).

Procedures of testing resistance :

Process of testing:

Under bioassay methods such as leaf dip and larvae dip were used in the laboratory conditions for testing lethal dose of insect pests. At least five dilutions for each of the selected insecticides were tested serially using different methods. In each method and insecticide at least 10 larvae of 2-3rd instars were released on each dilution in 3 replications along with untreated control under laboratory condition.

Leaf dip bioassay :

Larvae of 2-3rd instars of diamond back moth, *P. xylostella* L. and cabbage semiloopers, *T. ni* were exposed to insecticide by using leaf dip bioassay method (Anonymous,1990) by the insecticide resistance action committee (IRAC). Fresh cabbage leaves were collected

Dose (*D*)	No. of insects (*n*)	No. killed (*r*)	Log (10.*D*) (*x*)	Proportion killed (*p*)	Empirical probits (y_e)	Expected probits (y_p)	Weighting co-efficient (*w*)	(nw)	Working probits (*y*)	Estimated probits ($y^{\wedge}$)
1	2	3	4	5	6	7	8	9	10	11
D1	N1									
D2	N2									
D3	N3									
D4	N4									
D5	N5									

from unsprayed plots and were dipped in dilutions serially (1, 2, 3, 4 and 5) on tested insecticides (cypermethrin 10% EC) for 15 seconds with gentle agitation and then allowed to dry paper, towel on both sides. 10 larvae of 2-3rd instars were released on each leaf disc placed in a 5 cm diameter Petridish with adaxial side up and serial dilutions were used for test insecticide including untreated check. Moistured filter papers were placed under the leaf disc to prevent quick drying of disc. Petridishes alongwith larvae were covered with a lid to avoid escape under laboratory conditions. The mortality of both the larval were observed after 12 hours exposure period.

Larvae dip bioassay :

Totally 160 larvae of *H. armigera, L. arbonalis* and *S. litura,* were collected from unsprayed brinjal and cauliflower fields and dipped into the dilutions (1, 2, 4, 6 and 8) serially on the tested insecticides for few seconds. Thereafter, the tested larvae were transferred in to new Petridish having 5 cm diameter. 10 larvae of 2-3rd instars were released on the Petridish having feeding material and placed in the Petridish under laboratory conditions. Mortality was observed 12 hours after exposure period.

LD_{50} determination :

Lethal dose of each insecticide was determined LD_{50} of insecticides *viz.,* chlorpyriphos 20 per cent EC and cypermethrin 10 per cent EC by probit analysis programme on the basis of following D.J. Finney's method. The determination of LD_{50} by required the doses used, number of insects used in each dose, number of dead insects in each dose, number of insects used in control and the nature of dead insects in control.

RESULTS AND DISCUSSION

The *H. armigera* (H.) population recorded a maximum LD_{50} value to Chlorpyriphos (0.633 µg/lit) followed by *S. litura* (H.) population LD_{50} (0.576 µg/lit) and lower value for *L. arbonalis* (Guen.) LD_{50} (0.503 µg/lit). The *H. armigera* (H.) showed higher resistance towards Chlorpyriphos application, followed by *S. litura* (H.) and *L. arbonalis* (Guen.). There was no significant changes observed under the untreated at 0.05 per cent level of significance. The *P. xylostella* (L.) population showed maximum LD_{50} value to Cypermethrin (0.810µg/l) and lower value for *T. ni* (H.) LD_{50} (0.246 µg/l). The *P. xylostella* (L.) showed higher resistance towards Cypermethrin and lower for *T. ni* (H.) (Table 1). There was no significant changes observed under the untreated at 0.05 per cent level of significance. The work carried out in Raipur district for various strains of insects regarding their LD_{50}, resistance towards insecticide application (Chlorpyriphos 20% EC, Cypermethrin 10% EC) showed the results somewhat similar work done by Nimbalkar *et al.* (2009) for various strains of insects. The study showed that the *H. armigera* (H.) population recorded a maximum LD_{50} value to Chlorpyriphos (0.172 mg/l) in Aurangabad strain followed by Parbhani strain population maximum LD_{50} were 0.046 µg/lit.

Terefe *et al.* (2004) investigated resistance to the field rates of profenofos, endosulfan and lambda-cyhalothrin using adult vial, topical application, square dip and larval immersion techniques. It was found that LD50 values of endosulfan, profenofos and lambdacyhalothrin in the third instar topical bioassay were 29.84, 4.068 and 0.18 mg/g body weight, respectively. In the square dip test profenofos (Calofos) resulted in 100 per cent kill at two-times lower dose (1.25 ¥ 10^{-3} g a.i/ml) and 86.67 per cent larval deaths were observed at four-time lower dose. Carneiro *et al.* (2014) tested insecticides from different chemical groups by laboratory bioassay to verify the percentage mortality of *H. armigera*. The results demonstrated that

Table 1 : Log dose probit response of insect pests of vegetables to different insecticides through bioassay methods

Name of insects/ Insecticides	n	LD_{50} µg/lit	95% CL	Slope ± SE	$t^{(df)}$
Chlorpyriphos 20 % EC					
Helicoverpa armigera (H.)	160	0.633	0.231– 0.746	1.077±0.183	5.86 (3)
Leucinodes arbonalis (Guen.)	160	0.503	0.149 – 0841	1.047±0.184	5.66 (3)
Spodoptera litura (H.)	160	0.576	0.252 – 0.772	1.355±0.178	7.60 (3)
Cypermethrin 10 % EC					
Plutella xylostella (L.)	160	0.810	0.296 – 0.822	1.094±0.196	5.57 (3)
Trichoplusia ni (H.)	160	0.246	0.146 – 0.535	1.791±0.519	3.44 (3)

n = No of insects, LD_{50} = Median lethal dose, µg/lit = Microgram/ larvae, CL = Confidence limits, SE = Standard error, df = Degree of freedom

chlorpyrifos and spinosad were effective against third instar *H. armigera* larvae both on contact and by ingestion. Flubendiamide, acephate, methomyl, *Bacillus thuringiensis*, dimethoate, chlorantraniliprole and fipronil had good responses to control of *H. armigera*. Tukaram *et al*. (2014) found the bioassay of Flubendiamide 39.5 per cent SC against *S. litura* (Fab) populations collected from different host crops by leaf dip method. The result revealed that the population collected from castor recorded minimum LC_{50} value of (2.66 ppm) and it was followed by sunflower (2.81 ppm), groundnut (2.82 ppm), onion (2.86 ppm), cabbage (2.90 ppm) and soybean (2.94 ppm). Saeed *et al*. (2012) evaluated the effectiveness of different insecticides against field populations of 2nd instar larvae of *S. exigua*. Bioassays were performed through leaf dip method to evaluate the dose- and time-mortality response for emamectin benzoate, lufenuron, chlorpyrifos and cypermethrin. Significant variation was revealed in lethal concentration and lethal time values. Among all the tested insecticides emamectin benzoate gave the lowest LC_{50} value *i.e.*, 0.005 mg/lit (95% FL: 0.93 mg/lit).-0.007 mg/lit) followed by lufenuron *i.e.*, LC_{50} value 0.65 mg/lit (95% FL: 0.38-0.004).

Acknowledgement :

The authors are thankful to Dr. D. J. Pophaly, Head, Department of Entomology, I.G.K.V. and Raipur for encouragements, useful suggestion and providing necessary facilities to conduct the experiment.

REFERENCES

Alfred, S.Y., Cleav, B.K., Afgan and James, W.R. (1982). *Analysis of pesticides in water*. Vol. **I**, CRC Press Inc., Boca Raton, Florida, USA.

Anonymous (1990). Proposed insecticide/acaricide susceptibility test, IRAC method No.7, *Bull. Eur. Plant Protect. Org.*, **20** : 399-400.

Carneiro,E., Silva, L.B., Maggioni, K., Santos, V.B.D Rodrigues, T.F., Reis, S.S. and Pavan, B.E. (2014). Evaluation of insecticides targeting control of *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae), *American J. Plant Sci.*, **5** : 2823-2828.

Chawla, R.P. and Joia, B.S. (1991). Toxicity of some synthetic pyrethroids against *Plutella xylostella* (L.) in India ANPP-2nd Int. Nat. Conf. on pests in Agric. 4-6 December, 1990. pp. 66-79.

Martin, T., Ochou, G.O., Hala-N.K.F., Vassal, J.M. and Vaissayre, M. (2000). Pyrethroid resistance in the cotton bollworm, *Helicoverpa armigera* (Hubner), in West Africa. *Pest Management Sci.,* **56**(6): 549-554.

Metcalf, R.L. (1980). Changing role of insecticides in crop protection. *Ann. Rev. Entomol.*, **25**: 219-256.

Nimbalkar, R.K., Shinde, S.S., Tawar, D.S. and Muley, S.P. (2009). Response of cotton bollworm *Helicoverpa armigera* (Hubner) (Lepidoptera:noctuidae) to different insecticides in Maharashtra, India. *World J. Agric. Sci.*, **5** (2): 250-255.

Oppenoorth, F.J. (1985). Bio-chemistry and genetics of insecticide resistance. In: Comparative insect physiology, biochemistry and pharmacology. *Insect Control*, **12**: 731-773.

Parmar, B.S. and Dureja, E. (1990). *Minimizing environmental hazards of agrochemicals*, 2nd Ed. Soc. *Pesticide Science*, pp. 1-57, NEW DELHI, INDIA.

Raju, S.V.S. and Singh, H.N. (1995). Resistance levels in the field population of *Plutella xylostella* L. to certain commonly used insecticides. *India J. Entomol*., **5**: 23-24.

Roush, R.T. (1997). *Managing resistance to transgenic crops.* Advances in insect control: The role of transgenic plants. pp. 271-294.

Saeed,Q., Saleem, M.A. and Ahmad, M.(2012). Toxicity of Some Commonly Used Synthetic Insecticides Against Spodoptera exigua (Fab) (Lepidoptera: Noctuidae). *Pakistan J. Zool.*, **44**(5): 1197-1201.

Saxena, J.D., Rai, S., Shrivastava, K.M. and Sinha, S.R. (1989). Resistance in the field populations of the diamond back moth to some commonly used synthetic pyrethroids. *Indian J. Entomol.*, **51** (3): 265-268.

Terefe, G., Jamornmarn, S., Hormchan, P., Daorai, A. and Impithuksa, S. (2004). Evaluating Four Bioassay Techniques for Insecticide Resistance Monitoring in *Helicoverpa armigera* (Lepidoptera: Noctuidae), *Kasetsart J.* (*Nat. Sci.*), **38**: 44 – 56.

Tukaram, A.H., Hosamani, A.C., Naveena R. and Santoshagowda, G.B. (2014). Bioassy of Flubendiamide on *Spodoptera litura* (Fab) population collected from different host crops, *Internat. J. Sci., Environ. & Technol.*, **3** (6): 2225 - 2230.