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Effect of different host plants on toxicity of indoxacarb to *Spodoptera litura* (Fab.)

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ABSTRACT

Five host crops *viz*., Castor, Sunflower, Cotton, Groundnut and Soybean belonging to different families were used to study the effect of different host on toxicity of indoxacarb to *Spodoptera litura* (Fab.) during the year 2011-12 and 2012-13. The larvae reared on Groundnut leaves were found most susceptible to indoxacarb with 0.969 and 1.305 ppm LC_{50} during 2011-12 and 2012-13 respectively. Whereas, the larvae reared on Castor leaves were found most tolerant with 2.544 and 2.969 ppm LC_{50} followed by Sunflower (2.510 and 2.795 ppm), Soybean (2.402 and 2.549 ppm) and Cotton (2.210 and 2.413 ppm) during 2011-12 and 2012-13 respectively. The order of toxicity was Castor> Sunflower> Soybean> Cotton> Groundnut. The results suggesting the role of host plants on toxicity of indoxacarb to *Spodoptera litura* (Fab.).

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INTRODUCTION

Spodoptera litura (Fab.) being the polyphagous pest with high reproductive and damage potential, its suppression has become inevitable over past decade due to development of resistance to commonly used chemical insecticides. In India it has attained the status of national pest, particularly notorious in most tobacco growing regions. In the last three and half decades, however, it has extended its host range to other crops such as cotton, soybean, mungbean, sunflower, cabbage and leafy vegetables, including groundnut (Maree *et al*., 1999) During 2008-09, in Vidarbha region of Maharashtra state of India, particularly in eastern districts there was outbreak of *S. litura* on soybean crop which caused heavy losses to soybean growers. In north India, (Jeyakumar *et al.,* 2007) carried out a survey in Haryana, reported increasing trend in population of *S. litura* (Fab.) larvae per plant of Bt. cotton and conclude with the threat of *S. litura* (Fab.): an emerging pest on Bt cotton (Cry 1Ac) under north Indian conditions.

In insecticide resistance management (IRM) strategies the effect of host plants on development of insecticide resistance cannot be neglected, as it has become an important component of the IRM strategies. Some plants have sufficient plant allelochemicals to tolerate the xenobiotics / toxicants which are easily detoxified by the different metabolic mechanisms. Plants can influence the toxicity of insecticide to insects indirectly by including higher activities of insecticide detoxifying enzymes (Broston, 1988).

The latest generation of insecticides includes an oxadiazine insecticide DPX-JW062 (Indoxacarb) having novel mode of action which is effective against lepidopteron pests. It is the first commercialized pyrazoline type sodium channel blocker can play a useful role in resistance management programmes because it has a mode of action not shared by other insecticide. Most studies on the toxicity to lepidopteron insects especially *Spodoptera litura* in the past fifteen years are concerned with Pyrethroid, organophosphate and other conventional insecticides. The study on Indoxacarb toxicity to *S. litura* (Fab.) with effect of different host plant is needed. In view of the above facts and looking the importance of study, the experiment was undertaken in Department of Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola with objective to study the toxicity of Indoxacarb against *Spodoptera litura* reared on different hosts which will be help full in designing the crop specific IPM programme.

MATERIAL AND METHODS

Collection and rearing of *S. litura*:

Eggs and larvae of *S. litura* were collected from the field, in and around District Akola, Maharashtra, India during the year 2011-12 and 2012-13 and reared in the laboratory under controlled condition. The larvae were reared in plastic jars on fresh leaves of castor, soybean, cotton, sunflower and groundnut up to final instar. Final instar larvae were transferred to jar containing sand for pupation. Pupae were collected and disinfected with 0.02 per cent sodium hypochlorite solution. Disinfected pupae were sexed by morphological characters (Krickpatric, 1961) and transferred to adult emergence chamber. Adults were transferred into mating chamber by maintaining male and female ratio 1:1. Adult diet was provided and three pairs were released in each mating chamber and in consecutive second generation the neonates were transferred on fresh leaves of respective crops, third instar larvae were used for bioassay to determine the LC_{50} value of different population of *S. litura* reared on leaves of different host plants.

Larval diet :

Fresh leaves of castor, soybean, cotton, sunflower and groundnut were used as diet for larvae.

Adult diet composition :

50ml honey, 50g sucrose, 2.5g aureomycin, 1g streptomycin sulphate, 1g vitamine E capsul, 1g methyl paraben, 1ml formaldehyde (10% v/v), multivitamine 1g, 500ml distilled water.

Preparation of insecticide solution:

Indoxacarb 15.8 EC trade name Avaunt was used for the present investigation. The insecticide solutions were prepared using the commercial formulation which was diluted with distilled water. Fresh solution was prepared as and when required. Concentration of insecticide was prepared by using following formula:

$$V = \frac{C \times A}{a.i.}$$

where,

V- Volume of water to be added.

C- Required concentrations of insecticide.

A- Required quantity of solution.

a.i.- Active ingredient in insecticide formulation.

Log dose probit (LDP) bioassays:

Serial dilution of the insecticide was prepared for bioassays using leaf dip method. Larvae were fed with insecticide treated leaf disc of respective crop. Five concentrations along with three replications and control were used for each bioassay. These treated leaves and larvae were kept in controlled condition for mortality assessment. Mortality observations were recorded after 24 hours till 76 hours. The median lethal concentration (LC_{50}) of insecticide was worked out by subjecting the mortality data to probit analysis (Finney, 1977) and corrected mortality was calculated by using Abbott's formula (Abbott, 1925).

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

Influence of host plants on toxicity of indoxacarb to *S. litura* (Fab.) collected from the field of Akola during 2011-12 :

The data obtained during 2011-12, presented in Table 1 revealed that minimum LC_{50} of indoxacarb was found in the *Spodoptera litura* fed on groundnut (0.969 ppm). The LC_{90} for the same population was 4.666 ppm. Maximum LC_{50} of indoxacarb was obtained from the population reared on castor leaves (2.544 ppm). The resistance ratio for castor population was 2.62 folds as compared to groundnut fed population. As regards the sunflower, soybean and cotton the $LC_{50's}$ were 2.510, 2.402 and 2.210 ppm, respectively. The $LC_{90's}$ for the same populations were 7.692, 7.128 and 7.076 ppm, respectively.

Influence of host plants on toxicity of indoxacarb to *S. litura* (Fab.) collected from the field of Akola during 2012-13 :

The results of influence of host plant on toxicity of indoxacarb to *Spodoptera litura* larvae during 2012-13 are presented in Table 2 and Fig. 1. The results revealed that the maximum LC_{50} of indoxacarb was obtained from the population reared on castor leaves (2.969 ppm) with highest resistance ratio 2.27 as compared to the population reared on groundnut leaves. The lowest $LC_{50,}$

Table 1 : Influence of host plants on toxicity of indoxacarb to *S. litura* (Fab.) collected from the field of Akola during 2011-12

Sr. No.	Host plant	LC_{50} ppm (95% FL)	LC_{90} ppm	Slope (±SE)	Chi square	RR
1.	Castor	2.544 (2.100-2.989)	6.588	3.102 (± 0.68)	0.644	2.62
2.	Cotton	2.210 (1.596-2.825)	7.076	2.531 (± 0.62)	1.346	2.28
3.	Groundnut	0.969 (0.654-1.469)	4.666	1.877 (± 0.54)	1.374	--
4.	Soybean	2.402 (1.850-2.952)	7.128	2.713 (± 0.65)	0.93	2.47
5.	Sunflower	2.510 (2.038-3.075)	7.692	2.635 (± 0.52)	1.367	2.59

Table 2 : Influence of host plants on toxicity of indoxacarb to *S. litura* (Fab.) collected from the field of Akola during 2012-13

Sr. No.	Host plant	LC_{50} ppm (95% FL)	LC_{90} ppm	Slope (±SE)	Chi square	RR
1.	Castor	2.969 (2.522-3.449)	6.996	3.443 (± 0.76)	1.218	2.27
2.	Cotton	2.413 (1.846-2.994)	7.421	2.627 (± 0.66)	0.600	1.84
3.	Groundnut	1.305 (0.729-2.051)	7.562	1.679 (± 0.50)	2.202	--
4.	Soybean	2.549 (1.959-3.167)	6.790	3.011 (± 0.74)	1.315	1.95
5.	Sunflower	2.795 (2.228-3.448)	7.789	2.879 (± 0.73)	0.795	2.14

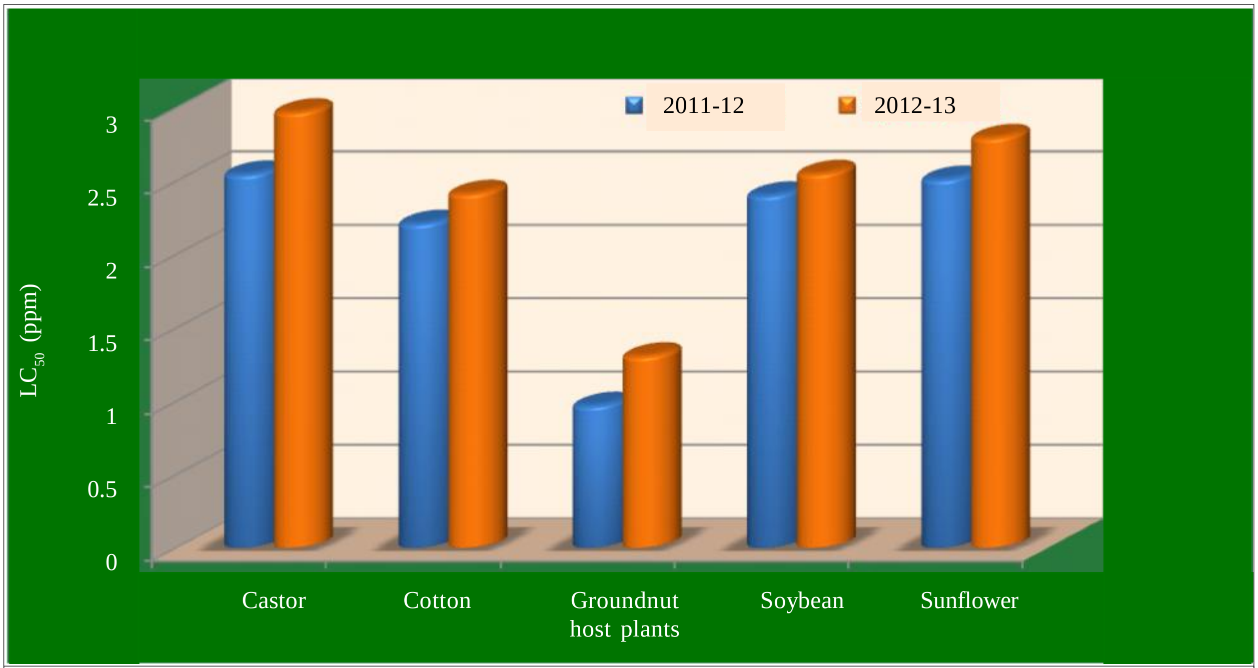

Fig. 1 : Influence of host plants on toxicity of indoxacarb to *S. litura* (Fab.) collected from the field of Akola during 2011-12 and 2012-13

1.305 ppm was recorded in the population reared on groundnut leaves with LC_{90} 7.562 ppm. As regards the sunflower, soybean and cotton the $LC_{50's}$ were 2.795, 2.549 and 2.413 ppm, respectively with resistance ratio 2.14, 1.95 and 1.84 folds, respectively.

The castor, sunflower, soybean and cotton leaves fed larvae were almost 2.00 fold resistant as compared to groundnut leaves fed larvae. The data indicated that the host plant allelochemicals or secondary metabolites influence the toxicity of indoxacarb in *Spodoptera litura*.

In insecticide resistance management (IRM) strategies the effect of host plants on development of insecticide resistance cannot be neglected, as it has become an important component of the IRM strategies. The effect of host plants during the investigation revealed that the indoxacarb toxicity is influenced by host plants. During both the years castor leaves fed larvae showed more tolerance to indoxacarb followed by sunflower, soybean and cotton leaves fed larvae. The *Spodoptera litura* larvae fed on groundnut leaves was found most susceptible to indoxacarb. Some plants have sufficient plant allelochemicals to tolerate the xenobiotics / toxicants which are easily detoxified by the different metabolic mechanisms. Plants can influence the toxicity of insecticide to insects indirectly by including higher activities of insecticide detoxifying enzymes.

The present findings confirms with the findings of followings; Basera and Srivastva (2011) studied the influence of host plants on the susceptibility of tobacco caterpillar, *Spodoptera litura* (Fab.) to certain insecticides and observed that in case of indoxacarb, lowest LT_{50} value of 19.57h was observed when *S. litura* larvae were reared on soybean as compared to larvae reared on the castor (23.08h) and brinjal (31.0h). Ming Xue *et al.* (2010) reported that the *S. litura* larvae reared on tobacco leaves were most tolerant to insecticide, whereas the larvae which fed on sweet potato were found most susceptible. Kulkarni and Lingappa (2002) observed *S. litura* larvae fed on groundnut were the most susceptible to *N. rileyi* (5.79 and 8.29 conidia/ml × 10^6) followed by those fed on soybean (5.98 and 8.53 conidia/ml × 10^6) and potato (6.96 and 9.75 conidia/ml × 10^6). The larvae fed on cotton were the least susceptible. Ravishankar and Venkatesha (2010) found that the LC_{50} value was highest in rose followed by groundnut, potato, cotton and cabbage. It has been widely recognized that, when insect pests feed on different host plants or diets, they have different responses or susceptibility to insecticides, which may increase, decrease or remain unchanged. It is believed that these changes are related to the activation or inhibition of insect detoxifying enzymes induced by plant allelochemicals, while the induction levels are influenced by various factors such as plant nutrients, structures and distributions of allelochemicals, species and development stages of insects as well as the temperature, humidity etc.

In summary, *Spodoptera litura* (Fab.) that fed on different diets had different susceptibility to indoxacarb. The larvae that were fed with groundnut leaves were most susceptible to indoxacarb during both the years, as compared with those fed with Castor leaves followed by Sunflower, Soybean and Cotton leaves fed larvae. The results of the present study have important implications for the development of IPM strategies for *Spodoptera litura* (Fab.) on different crops and have highlighted the need to examine the compatibility of single-component pest management option before they are recommended in such strategies.

REFERENCES

Abbott, W.S. (1925). A method of computing the effectiveness of an insecticide. *J. Econ. Ent.,* **18**: 265-267.

Basera, Anju and Srivastva, R.P. (2011). Influence of host plants on the susceptibility of tobacco caterpillar, *Spodoptera litura* (Fab.) to certain insecticides. *Pest Mgmt. Hort. Ecosystems,* **17**(1): 51-53.

Broston, L.B. (1988). Potential role of plant alellochemicals in the development of insecticide resisitance. p 313-348, In herbivores : Novel Aspects of Insect- Plant Interactions. P. Barbosa and D.K.Letourneas (eds), John Wiley and sons. New York.

Finney, D.J. (1977). *Probit Analysis: Statastical treatment of the sigmoid response curve,* Cambridge University Press, London, New York and Melbourne. pp 333.

Jeyakumar, P., Tanwar, R.K., Jat, M.C., Dhandapani, A., Bambawale, O.M. and Monga, D. (2007). *Spodoptera litura:* An Emerging Pest on Bt Cotton (Cry 1Ac) under North Indian conditions. *Pesticide Res. J.,* **19** (2) :197-200.

Krickpatric, T.H. (1961). Comparative morphological studies of *Heliothis species* (Lepidoptera: Noctuidae) in Queensland. *Queensland J. Agril. Sci.,* **18** : 179-194.

Kulkarni, N.S. and Lingappa, S. (2002). Remove from marked records influence of host plants on the susceptibility of *Spodoptera litura* to entomopathogenic fungus *Nomuraea* *rileyi* (Farlow) Samson. Resources management in plant protection during twenty first century, Hyderabad, India, 14-15 November 2002. (II): 33-35.

Maree, J.M., Kallar, S.A. and Khuhro, R.D. (1999). Relative abundance of *Spodoptera litura* F. and Agrotis ypsilon Rott. on cabbage. *Pakistan. J. Zool.,* **31**: 31–34.

Ming Xue, Yung-Hong Pang, Quing-Liang Li and Tong-Xian Liu (2010). Effect of four host plants on susceptibility of *Spodoptera litura* (Lepidoptera: Noctuidae) larvae to five insecticides and activities of detoxification esterases. *J. Yangzhou Univ.,* **31**: 74-80.

Ravishankar, B.S. and Venkatesha, M.G. (2010). Effectiveness of *SlNPV* of *Spodoptera litura* (Fab.) (Lepidoptera: Noctuidae) on different host plants. *J. Biopesticides,* **3** (1 Special Issue): 168 – 171.