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Effectiveness of SINPV against *Spodoptero litura* on different host plants.

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Abstract: Tobacco caterpillar, *Spodoptera litura* is one of the important agricultural pests. It is widely distributed to the whole of the Asia, United States and oceanian lands i.e. Australia, New Zealand, Papua New Guinea. It is very common in tobacco farms in the North Bihar. The pest invasion in crop is observed with the presence of egg-mass covered with hair scales on the underside of young leaves. The young larval first feed gregariously the leaves, stems buds flowers etc and then older larvae spread out and may completely devour the leaves resulting in poor growth of plants. The leaves of infested plants have holes and become skeletonized leaves. In my observation the damage is done only by the caterpillar. The features of caterpillar and adult insect are similar as described earlier. The result of all the experiments conducted to know the influence of host plants on the effectiveness of SINPV against *S. litura* larvae revealed that there was a significant variation in the LC_{50} values among different host plants and it was lowest in cabbage and highest in castor. Similarly. LC_{50} values of SINPV screened against *S. litura* varied in different host plants.

Keywords : Tobacco , *Spodoptera litura,* caterpillar ,pests, effectiveness of SINPV

INTRODUCTION

Spodoptera litura is a potential pest of tobacco and cotton. This oriental leaf-worm is highly polyphagus defoliation on many. It is widely distributed to the whole of the Asia, United States and oceanian lands i.e. Australia, New Zealand, Papua New Guinea. This insect has many common names like common cutworm, rice cutworm tobacco-cutworm, tobacco bud-worm, tropical army-worm, cluster caterpillar, taro caterpillar, tobacco caterpillar and cotton leaf-worm etc. It is very serious, sporadic and highly injurious pest with a swarming character. It is also called army-worm because of its nature of invasion from one field to another in the same manner as that of army, destroying the crops.

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It is very common in tobacco farms in the North Bihar and also invades rice crop in the October to February in Indian sub continent. However it attacks rice in rainy season when rains take place after dry spell. Other plant hosts of this pest range over 120 plant species which includes cotton, tobacco, rice and many vegetable, fruit, ornamental and medicinal crops. Some examples are alfalfa, alpinia, amaranth, apples, asparagus, beets, broccoli, bitter gourd cabbage, carrots, chrysanthemum, corn, cruciferous crops, dry beans, eggplants, fuchsia, geranium, gladiolus, grapes, hibiscus, leek, lettuce, mint, orchid pink, potatoes, radish, roses and sunflowers.

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However a survey by me was done for 3-4 years and I found its infestation in tomato. Sunflower, paddy, bitter gourd (Karela) and other cruciferous plants. In my observation the damage is done only by the caterpillar. The features of caterpillar and adult insect are similar as described earlier.

In Various species of lepidopteron pest management, increasing failures of chemical pesticides and the problems posed by their indiscriminate use in the field have created a momentum to develop environment friendly methods of pest control. Among the alternatives that are currently available is the use of insect viruses remain the most promising, considering the fact that they can be used in a manner similar to the familiar chemical pesticides. Unlike other natural enemies, insect viruses can be produced and stored and made available to the farmers at short 'notice due to their longer shelf life. Of the various insect viruses, **nuclceopolyhedroviruses** (NPV) are more successful in pest management[1]. *S. litura* has already developed resistance to several organic pesticides resulting severe crop losses[2]. Fortunately, the pest is highly susceptible to its NPV and studies have shown that the virus can be used effectively as bio pesticide in the field[3]. ***Spodoptera litura* nucleopolyhedrovirus (SINPV)** is the most promising control agent and its efficacy has been established successfully against the pest in India[4,5]. Considering the reliability, suitability and effectiveness of SINPV in terms of economic and ecological reasons, its utilization in pest management has received great deal of significance.

Although SINPV has been found every effective against *S. litura* greater amount of variation in the efficacy of SINPV across the host plants hindered its practical utility in the field condition as reported in other lepidopteron pests[6-10]. Variable efficacy of SINPV and mortality of *S.litura* larvae on different host plants may be related to the secondary metabolites, enzymes and pH of host plants. Keeping these challenges in mind the preliminary investigations were undertaken to understand the effectiveness of SINPV against *S. litura* on different host plants.

MATERIALS & METHODS

Disease-free colonies of *S. litura* were maintained on semi-synthetic diet following the method of Roberts[1]. In the first experiment to understand the effectiveness of SINPV on *S. litura* larvae, which were reared on different host plans and to avoid the direct contact between host plants and SINPV, fresh larvae of *S. litura* from the laboratory culture on Semi-synthetic diet were reared on different pot cultured host plants such as cabbage, cotton, groundnut, potato and rose in the green house. The newly emerged female and male moth from these cultures were paired and caged separately for egg laying. When the eggs hatched the second generation neonate larvae were transferred to the respective host plants and reared up to the end of second instar. When they reached third instar, the larvae of iniform size were synthetic died. SINPV was assayed against these larvae on semi-synthetic diet by adopting diet surface contamination method in the laboratory following the earlier procedure[9].

In the second experiment, to understand the effect of host plants in SINPV efficacy by direct contact, lab cultured uniform sized fresh third instar larvae of S. litura on semi-synthetic were selected and fed individually with fresh leaf dises (5mm diameter) of various host plants treated with SINPV for one day in the laboratory. Subsequently, the treated larvae were provided respective fresh larvae (without SINPV) at every 24 hrs. In the third experiment, to understand the interaction between host plants (direct contact, host plant secondary metabolites, enzymes, pH) and SINPV, fresh larvae of S. litura were reared on different host plants. The newly emerged adults were paired and eagled separately for egg laying. When the eggs hatched neonate larvae of second generation were transferred to the respective pot cultivated host plants and reared up to the end of second instar. When they reached third instar, the larvae of uniform size were selected and reared on fresh leaf dises of different host plants treated with SINPV. In all the above experiments, to force the larvae to ingest the SINPV treated food, they were kept starved for 2 hr. before assaying SINPV as followed earlier[3]. In the above experiments, the larvae reared on respective host plants without treatment of SINPV were maintained as control. For each treatment, there were three replications with ten larvae per replication. Bioassay of SINPV at different concentrations ($1x10^6$, $2x10^5$, $4x10^4$, $8x10^3$, $1.6x10^3$, $3.2x10^2$) was conducted EC50 of SINPV was assessed using Probit analysis[7].

RESULTS & DISCUSSION

Tobacco caterpillar, *S. litura* is one of the important agricultural pests. The effect of several control approaches, i.e. chemical control, frequency trembler grid lamps and pheromone traps, the methods based on plant attractiveness and repellency, transgenic plant, and biological control, was studied in order to reduce the population of *S. litura.* Chemical control made a great contribution to suppressing occurrence of *S. litura* and reducing its damage, *S. litura* larvae reared on different host plants and subsequently fed with semi-synthetic diet treated with SINPV showed significant variations in virulence ($P < 0.05$). LC_{50} values with respect to different host plants ranged from 0.42 to 1.28 POB per mm^2=(Polyhedral reclusion bodies per mm^2). The highest LC_{50} value was recorded in cater and the lowest was in cabbage (Table 1). Bioassay of SINPV using early third instar larvae of *S. litura* reared on semi-synthetic diet and subsequently fed with SINPV treated leaf discs of various host plants showed significant variations in virulence ($P<0.05$). LC_{50} values in different host plants ranged from 0.40 to 1.81 POB per mm_2. The highest LC_{50} value at relation to various host plants ranged from 1.02 to 19.50 POB per mm_2. Again the highest LC_{50} value was recorded in castor and the lowest was in cabbage (Table-3). In the above experiments, the increasing larval mortality was noticed from fourth to tenth day after treatment. Moreover, the larval mortality was also increased with increasing concentration of SINPV irrespective of the host plants.

The result of all the experiments conducted to know the influence of host plants on the effectiveness of SINPV against *S. litura* larvae revealed that there was a significant variation in the LC_{50} values among different host plants and it was lowest in cabbage and highest in castor. Similarly, LC_{50} values of SINPV screened against *S. litura* varied in different host plants[8]. It is known that the leaf exudates from glandular hairs of the Tobacco plants inactivate the NPV of Leliothis spp.[6] Further, it is reported that plants mediate interactions between insect and its pathogens, which increase or decrease the impact of the insect pathogen[10]. From the present experiments it could be made out that different host plants influence the effectiveness of SINPV by direct or indirect means. Further investigations on the leaf pH and secondary metabolites of different host plants may provide what are the factors interfere with the virulence of SINPV. Eight of baculoiruses genes help the virus overcome insect defenses[11].

Table 1 : *S. litura* reared on different host plants and assayed against SINPV on semi-synthetic diet.

Host plants	X^2* (n-2)	Slope'b'± S.E.	LC50 (POB/ mm^2)	Fiduecial limits		LC_{50}(POB/mm^2)
				Lower	Upper	
Cabbage	0.51	0.86±0.10	0.42	0.22	0.76	201.65
Tobacco	0.75	0.02±0.11	0.61	0.34	1.09	199.64
Potato	1.80	0,73±0.09	0.75	0.38	1.49	1124.63
Soybean	0.15	0.72±0.09	0.93	0.47	1.87	1459.69
Castor	0.48	0.66±0.09	1.28	0.62	2.80	4028.39

* All lines are significantly a good fit ($p<0.05$)

Table 2 : *S. litura* reared on semi-synthetic diet and assayed against SINPV on different host plants.

Host plants	X^2* (n-2)	Slope'b'± S.E.	LC50 (POB/ mm^2)	Fiduecial limits		LC_{50} (POB/mm^2)
				Lower	Upper	
Cabbage	0.40	0.70±0.09	0.40	0.19	0.81	848.87
Tobacco	0.47	0.71±0.09	0.81	0.40	1.64	1501.95
Potato	1.69	0.55±0.08	0.94	0.40	2.31	14136.66
Soybean	0.22	0.70±0.09	1.36	0.68	2.86	2784.34
Castor	0.84	0.63±0.09	1.81	0.86	4.25	8136.75

* All lines are significantly a good fit ($p<0.05$)

Table 3 : Effectiveness of SINPV against *S. Litura* on different host plants.

Host plants	X^2* (n-2)	Slope'b'± S.E.	LC50 (POB/ mm^2)	Fiducial limits		LC_{50}(POB/mm^2)
				Lower	Upper	
Cabbage	0.84	0.60±0.09	1.02	0.47	2.33	6768.36
Tobacco	0.44	0.62±0.09	2.27	1.07	5.56	11495.64
Potato	0.14	0.48±0.08	4.48	1.72	17.60	255101.49
Soybean	0.88	0.46±0.08	8.14	2.83	44.60	865931.08
Castor	0.23	0.35±0.08	19.50	4.58	443.06	61947027.97

* All lines are significantly a good fit ($p<0.05$)

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