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Effect of host plants on the infectivity and yield of nuclear polyhedrosis virus on *Spodoptera litura* (Fabricius)

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ABSTRACT : Fourth instar larvae of *Spodoptera litura* (Fabricius) were reared on six species of virus treated host plants and a semi-synthetic diet and observed the influence of host plants on virus induced mortality, yield of nuclear polyhedrosis virus (NPV) and virulence of resultant virus. Larvae infected through tobacco leaves recorded the highest mortality (91.7%), while it was lowest through cotton leaves (61.7%). The pH of food materials had negative relationship (r = - 0.85) with mortality. However, the variation among the host food with narrow range of pH (6.9 to 8) showed that the disparity of the influence of host food on the virus induced mortality may not be only due to pH. Larvae bred through virus contaminated semi-synthetic diet yielded maximum quantity of NPV (4.207 x 10^9 POBs / g of larva) which was 1.95, 1.28, 1.25, 1.13, 1.11 and 1.08 folds greater than cotton, groundnut, sunflower, tobacco and castor, respectively. LC_{50} and LT_{50} of NPV were also influenced by host plants and semi-synthetic diet.

KEY WORDS : LC_{50}, LT_{50}, pH, *Sl* NPV

Susceptibility of insects to microbial pathogens varied according to the type of host plants upon which they feed and also pH and constituents of the leaf tissues which either alter acquisition rate of pathogens or midgut pH of the insects (Benz, 1987). Infecting *S. litura* with NPV through castor leaves increased the acquisition of polyhedra which in turn caused the highest virus induced mortality (Mahadevan, 1978). The pH of leaf materials or extracts altered the activity of NPV either through additive or antagonistic effect (Kunimi and Aruga,

1974). Host plant foliar constituents and larval midgut conditions were responsible for the virus induced mortality of many lepidopteran insects (Keating *et al.*, 1990; Forschler *et al.*, 1992). As the *S. litura* larva is a polyphagous pest, generating information on the influence of different host plants on the infectivity of NPV on *S. litura* would be useful to manage this pest.

MATERIALS AND METHODS

Host plants used for the study were tobacco (cv. Meenakshi), cotton (cv. LRA 5166), groundnut (cv. VRI2), sunflower (cv. Co1), soybean (cv. Co1) and castor (cv. TMV5) and they were raised in pots inside the insectary, Agricultural College and Research Institute, Madurai during January 1995. Fourth instar larvae of *S. litura* cultured in the insectary, which had been reared for one generation on respective host plants and semi synthetic diet, were allowed to feed on the leaf discs of host plants smeared uniformly with one ml of NPV at 1 x 10^8 POBs / ml after shade drying. In the bengalgram flour based semi-synthetic diet (Udayakumar, 1987), larvae were reared continuously from inoculation. Virus induced mortality was recorded from fifth day onwards up to eighth day at 24 h interval. Leaf area consumed by the larvae 24 h after feeding was measured by tracing the leaf discs on graph sheets and computing the area. Weight of virosed larva at moribund stage and yield of NPV (POBs / gram) of larva were recorded. The pH of host plant tissue and semi-synthetic diet was recorded and correlated with final virus induced mortality.

Virus extracted from diseased larvae which had been reared on different host plants and semi-synthetic diet was diluted and applied to the leaf discs of respective host plants at concentration ranging from 1 x 10^1 to 1 x 10^6 POBs / ml. Fourth instar larvae were infected and virus induced mortality was recorded. Variations in virulence of NPV due to host plants and semi-synthetic diet were measured by calculating median lethal concentration (LC_{50}) and median lethal time (LT_{50}). Finally, relative activity was calculated (Shapiro and Robertson, 1992).

RESULTS AND DISCUSSION

The effect of six common host plants and semi-synthetic diet on the mortality of *S. litura* larvae to a constant dose of NPV caused differential mortality response. The mortality of larva fed on tobacco and sunflower was maximum (91.7 and 90.0%, respectively) followed by castor (86.7%) and cotton (61.7%) (Table 1). Semi-synthetic diet, groundnut and soybean occupied intermediate positions in enhancing virus induced larval mortality. Maximum larval mortality on treated tobacco and sunflower was due to the voracious feeding of the larvae on these plants which in turn made them to ingest maximum inoculum.

Leaf area eaten by larvae had positive relationship with mortality and yield of NPV and larvae infected through castor, tobacco and sunflower consumed maximum quantity of leaf (42.07, 41.45 and 39.09 cm^2 / larva, respectively)

Table1. Influence of host plants and semi-synthetic diet on larval mortality, leaf area consumption, larval weight and yield of NPV of *S. litura*

Host plant/ diet	pH (%)	Larval mortality	Leaf area consumed cm^2/larva/ 24 h	Weight/ larva (g)	Yield ($x10^9$) POBs / g of larva
Tobacco	6.9	91.07 (73.39)[a]	41.45[a]	0.620[b]	3.394[b]
Cotton	8.0	61.07 (51.77)[d]	23.04[c]	0.386[e]	1.871[e]
Groundnut	7.7	76.07 (61.16)[c]	27.39[b]	0.474[d]	2.843[d]
Sunflower	7.2	90.00 (71.80)[a]	39.09[a]	0.523[c]	3.328[c]
Soybean	7.8	74.09 (60.03)[c]	28.44[b]	0.482[d]	2.777[d]
Castor	6.8	86.07 (68.61)[b]	42.07[a]	0.611[b]	3.742[b]
Semi-synthetic diet	7.8	80.00 (63.43)[c]	-	0.724[a]	4.207[a]
Mean		80.02 (64.31)	33.58	0.546	3.166

In a column, means followed by the same letter(s) are not significantly different by DMRT (P= 0.05)

Figures in parentheses are arcsine transformed values

whereas on cotton, it was 23.04 cm^2 / larva 24 h post inoculation (Table 1). Jayaraj *et al.* (1976) reported such variation in respect of NPV of *Amsacta albistriga* (Wlk.) on various food plants. Low mortality of larvae fed on cotton was due to least preference as stated by Singh and Byas (1975). Many authors have reported the differential preference on various hosts by *S. litura* (Mahadevan,1978; Reddy, 1981; Balasubramanian, 1982).

The pH of host plants and semi-synthetic diet influenced the larval mortality by NPV and negatively correlated with per cent mortality (r = -0.85). The pH of food plants used in this experiment varied from near neutral

(tobacco) to alkaline (cotton) and alkaline pH reduced the mortality caused by NPV (Table 1). However, all food materials used recorded pH around neutral but showed variation among them in causing mortality indicating that pH of the leaf tissue is not only a factor to cause variation. As suggested by Forschler *et al.* (1992), presence of tannin content on cotton might be the reason for low susceptibility of larvae in addition to host preference. Leaf tissue pH and tannin content alter the midgut pH of insects which in turn strongly influences both POB distribution rates and virions survival (Ignoffo and Garcia, 1966; Gudauskas and Cannerday, 1968).

Larvae infected through semi-synthetic diet gained maximum weight of 0.724g/ larva which had positive relationship with the yield of NPV and subsequently increased the yield of NPV (4.207 x 10^9 POBs /g of larva). This was closely followed by tobacco (0.620g / larva) and castor (0.611g/ larva) with yield of 3.394 and 3.742 x 10^9 POBs / g of larva. Larvae infected through cotton yielded low quantity of NPV (1.871 x 10^9 POBs / g of

Table 2. LC_{50} and LT_{50} of *S. litura* NPV as influenced by host plants and semi-synthetic diet

Host plant / diet	LC_{50}[a] (x 10^4)	Relative activity	LT_{50} (h)	Relative activity
Tobacco	2.409 (0.898 - 6.614)	1.25	125.14 (120.00 - 131.87)	1.24
Groundnut	2.919 (1.009 - 8.462)	1.03	148.45 (133.33 - 162.15)	1.05
Cotton	3.017 (1.065 - 8.621)	1.00	155.29 (137.14 - 160.62)	1.00
Sunflower	2.629 (0.904 - 7.658)	1.15	130.54 (120.00 - 143.93)	1.19
Soybean	3.021 (1.038 - 8.803)	1.00	153.95 (141.98 - 166.80)	1.01
Castor	2.686 (0.908 - 7.895)	1.13	138.72 (127.92 - 150.24)	1.12
Semi-synthetic diet	2.686 (0.938 - 7.736)	1.12	145.86 (129.73 - 161.43)	1.06

Figures in parentheses are fiducial limits

a LC_{50}s expressed as POBs / ml

b Ratio of LC_{50}s and LT_{50}s where activity of NPV equals 1.00

larva) which was 1.95, 1.81 and 1.76 folds lesser than semi-synthetic diet, castor and tobacco, respectively (Table 1). High preference of *S. litura* to castor and tobacco might have increased the yield of NPV.

NPV obtained from soybean and cotton recorded highest LC_{50} (3.021 and 3.017 x 10^4 POBs / ml, respectively) which was reduced by 1.03 folds to 2.919 x 10^4 POBs / ml, 1.12 folds to 2.686 x 10^4 POBs / ml, 1.13 folds to 2.686 x 10^4 POBs / ml, 1.15 folds to 2.629 x 10^4 POBs / ml and 1.25 folds to 2.409 x 10^4 POBs / ml for groundnut, semi-synthetic diet, castor, sunflower and tobacco, respectively (Table 2). Similarly, LT_{50} for various food materials ranged from 125.14 h (tobacco) to 155.29 h (cotton). Variation among food materials on LC_{50}s and LT_{50}s of NPV was not significant, however, slight variation is obvious that more acquisition of inoculum by larvae at given time fed on preferred host would have reduced time and dose required to cause 50 per cent mortality.

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