



Antixenosis mechanisms of resistance in castor against tobacco caterpillar *Spodoptera litura* fab

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Abstract

Castor is the most important non edible oil seed crop. Castor is cultivated all over the world because of its oil and derivatives. Insect pests affecting castor are the major biotic factors in lowering of castor yield. Among that, Tobacco Caterpillar, *Spodoptera litura* (Fab.) (Noctuidae: Lepidoptera), is a major defoliator of castor. The management of *S. litura* often becomes difficult as there are no identified sources of resistance in castor against this pest. *S. litura* larvae are also less susceptible to insecticides. Hence, development of insect resistant castor is one of the promising approaches for management of the major Lepidopteron defoliator like *S. litura*. The present study was undertaken to analyse the antixenosis mechanism of resistance in selected castor accessions against Tobacco caterpillar *S. litura*. Based on the preliminary study, the promising accessions viz., IVHT-39, DCS-107, Salem Local, IVHT-29, IVHT-38 along with a susceptible check, IVHT-35 were selected. Feeding preference of *S. litura* larvae to the leaves of IVHT-39 and Salem Local was minimum in the confinement test. Salem Local recorded minimum feeding preference in free choice test. Ovipositional preference of *S. litura* adults, the accession Salem Local was least preferred in confinement test, whereas in free choice test IVHT-39 was least preferred.

Keywords: antixenosis, castor accessions, feeding preference, oviposition preference and *S. litura*

1. Introduction

Castor is cultivated around the world for its non-edible oilseed crop and has gained great potential in the world for its numerous industrial applications. Castor is a perennial crop but is also grown as an annual crop for an economic purpose. Oil content of castor seed varies from 35-58 percent. Castor seed oil play vital role in chemical industry as it act as a commercial source of a Hydroxylated fatty acid. In India, castor seed and its derivatives are mainly used in Paint Industry (45-50%), Soap Industry (25-30%) and Lubricants (15-30%). Though castor productivity in India is more than the world average, there are several production constraints in the traditional castor growing places, among them insect pest dominate the scenario. The yield loss due to insect pest has been in the range of 35-40 percent. Among the pests infesting castor, Tobacco Caterpillar *S. litura* is a major defoliator, under severe infestation it completely devours the green foliage, which by leaving only the veins. To mitigate pest problem, effort have been made to develop resistant genotypes Keeping this in mind, the present study was undertaken to analyse the feeding and ovipositional preference in the selected castor accession against *S. litura*.

2. Materials and Methods

Castor accessions collected from Tapioca and Castor Research Station, Yethapur were used for studying the resistance potentials against *S. litura*. Based on the preliminary study, the promising accessions viz., IVHT-39, DCS-107, Salem Local, IVHT-29, IVHT-38 along with a susceptible check, IVHT-35 were selected for further studies.

2.1 Mass rearing of *S. litura*

Culture of *S. litura* was initiated with field collected larvae. The full grown larvae were allowed to pupate in the

sterilized soil. After pupation, kept on a layer of saw dust spread in a petri plate and observed for adult emergence. The moths were fed with 10% sucrose solution. The emerging moths were collected using test tubes and allowed for mating and oviposition. Castor leaves with their stalks inserted into water in a small conical flask were placed inside the bucket for oviposition. After 2 to 3 days of adult release, the eggs were collected along with a little portion of the leaf, placed on moist filter paper and observed for eclosion. After hatching, the neonates were transferred to castor leaves. The containers and glassware used for the rearing were sterilized with 0.1% mercuric chloride solution (Muthukumar, 2004) [4].

2.3 Evaluation of feeding and ovipositional preference of *S. litura*

2.3.1 Relative leaf damage by confined feeding

Single third instar larva of *S. litura* was pre starved for six hours and then allowed into a specially designed screening cage on 45 days after sowing to feed individually on the leaves of castor plants. The screening cage consisted of cylindrical major film sheet rolled tubular (10.5 cm dia and 25 cm long), open and were affixed with muslin cloth and nylon mesh cloth at each end. The cage was fixed on top of a wooden stick (70 cm high) five such replications were maintained per treatment and the area of the leaf infested by the larvae after 6, 12 and 18 hours was measured.

2.3.2 Relative leaf damage by free choice

Relative preference of *S. litura* larvae to leaves of the test plants was ascertained by leaf disc method (Kauffman and Kennedy, 1989) [3]. Leaf disc of 25mm² size was excised from second leaf beneath the terminal bud of 40 days old plants from each treatment and were placed at equal distant circularly on moist filter paper in a 150mm dia petridish. Third instar larvae @ one per replication, pre starved for

hours were allowed to feed. The leaf area consumed by the larvae after 6, 12 and 18 hours was measured using graph sheet. This experiment was replicated five times.

2.3.3 Relative oviposition preference by confinement

Fresh shoot of each of the test castor accessions was excised and the twigs were kept immersed individually in nutrient solution (agar and water, 1: 100) in a 100 ml conical flask. The conical flask was enclosed in a big glass trough (30 cm x 25cm x 12.5cm) and a pair of pre-mated *S.litura* adults was released. Five such shoots were maintained for each castor accession individually. Ten per cent sucrose solution enriched with vitamin mixture was provided as diet for the moths. After 72 hours, number of egg masses laid in each castor accession was counted and number of emerging larvae was also recorded.

2.3.4 Relative oviposition preference by free choice

Fresh shoot of the selected castor accessions was excised and the shoots were kept together in a conical flask (1000 ml capacity) inside a plastic container (45 cm high and 45 cm diameter) in five replications and five pairs of pre-mated adults per replication were released. Number of egg masses laid and number of larvae emerging in each castor accession were recorded after 72 hours.

3. Results

3.1 Feeding preference of *S. litura* larvae

By confining the larvae on the selected promising accessions, it was observed that the minimum feeding was recorded on IVHT-39 (Table-1) followed by Salem Local. The maximum feeding was recorded on the accession IVHT-35. In contrast to confinement test, the third instar

larvae of *S. litura* were allowed to select the castor accessions by free choice test and when observed for feeding preference of the larvae based on percentage of leaf infestation, it was observed that the accession Salem Local was least preferred when compared to other selected castor accession. IVHT-35 was highly preferred by *S. litura* larvae (Table-1).

Table 1: Feeding preference of *S. litura* larvae towards the selected castor accessions

S. No.	Accession	Mean leaf infestation (%)	
		Confinement test	Free choice test
1	IVHT-39	5.15 (2.82)	63.47 (19.23)
2	DCS-107	11.94 (2.38)	58.62 (15.04)
3	Salem Local	8.84 (1.63)	47.61 (13.94)
4	IVHT-29	15.73 (1.80)	81.37 (16.12)
5	IVHT-38	21.46 (3.38)	84.12 (14.55)
6	IVHT-35	36.68 (3.60)	92.59 (9.38)
C.D. (p = 0.05)		3.08	15.64

Each value is a mean of five replications

Values in parentheses are arc sine transformed values

3.2. Ovipositional preference of *S. litura* adults

On studying the preference of *S. litura* adults on a individual castor accession, the number of egg masses laid on the foliage was minimum on the accession Salem Local and maximum on the accession IVHT- 35. In free choice test, the adults of *S. litura* were allowed to lay eggs in selected castor accessions. Among the selected castor accessions, the accession Salem Local was most preferred but the larval emergence was maximum in the susceptible check, IVHT-35 followed by the accession DCS-107. IVHT-39 was least preferred by *S. litura* adult for oviposition. (Table-2).

Table 2: Ovipositional preference of *S. litura* adults towards the selected castor accessions

S. No.	Accession	Confinement Test		Free Choice Test	
		No. of Egg Masses	No. of Larvae Emerged (%)	No. of Egg Masses	No. of Larvae Emerged (%)
1	IVHT-39	1.33 (1.24)*	53.00 (46.70)**	0.33 (1.13)*	46.00 (42.68)**
2	DCS-107	1.00 (1.52)*	49.00 (44.40)**	1.33 (1.52)*	72.00 (58.04)**
3	Salem Local	0.33 (1.62)*	47.00 (54.92)**	1.66 (1.62)*	67.00 (54.91)**
4	IVHT-29	1.0 (1.13)*	64.00 (53.11)**	0.33 (1.13)*	58.00 (49.58)**
5	IVHT-38	1.33 (1.13)*	72.00 (58.03)**	0.66 (1.27)*	43.00 (40.95)**
6	IVHT-35	1.66 (1.27)*	78.00 (62.01)**	0.66 (1.24)*	84.00 (66.44)**
C.D. (p = 0.05)		0.50	1.63	0.50	1.90

Each value is the mean of five replications

Values in parentheses are (*) square root and (**) arc sine transformed value

4. Discussion

Among the alternate strategies attempted for the management of this insect pest, identification, exploitation and utilization of host plant resistance are the best and viable option. (Hedge *et al.*, 2009) [1]. With reference to leaf feeding preference of *S.litura* larvae, by confining the larvae, the accessions IVHT 39 and Salem Local were less preferred by *S.litura* larvae. The same trend was also noticed on free choice condition. The accession Salem Local was collected from a hilly terrain in Salem district. Wild relatives or their derivatives have been reported to possess resistance against insect pests (Sankhyan and Verma, 1997) [5]. These results were similar with the previous findings of Sarma *et al.*, (2006) [6] who reported that the presence of wax particles could be the one of the causes of non-preference of consumption by the defoliators.

With reference to the oviposition preference of *S.litura*

female moths least preferred the accession IVHT 39 in free choice condition. In confined condition, Salem Local was less preferred. This may possibly be due to the blood of many wild species that possess insect and disease resistance (Kalloo, 1991) [2] and IVHT 35 was most preferred host for oviposition in both conditions. Further, Taylo and Bernardo (1996) [7] reported that higher phenol content impeded feeding and affect the bio stages of *E. vittella* in okra.

5. Conclusion

The present study showed that, the accession IVHT-39 and Salem Local were moderately resistant to *S. litura*. Hence, the accession IVHT-39 and Salem Local was more appropriate for cultivation in dry land areas under rainfed conditions with minimum pest infestation level and better yield. However, more in depth only after ascertaining the resistance potentials by such repeated evaluation of these

promising accessions could be recommended for large scale cultivation.

6. References

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