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Association of biochemical characters on shoot and fruit borer (*Leucinodes orbonalis* Gn.) resistance in green fruited brinjal

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Abstract

The field experiment was conducted with thirty green brinjal varieties to identify biochemical characteristics of brinjal plants for their resistance against shoot and fruit borer infestation. Various biochemical parameters like total phenol, polyphenol oxidase, total sugars and solasodine were recorded from different genotypes used. Among the genotypes, ABSR-2 recorded the low total sugar content, high total phenols and polyphenol oxidase activity was resistant to the infestation of *Leucinodes orbonalis*. Whereas, the susceptible genotype IC 249344 showed the lowest polyphenol oxidase and solasodine content. Out of thirty green genotypes, ABSR-2 exhibited highly resistant to shoot and fruit borer. Hence, the breeders can utilize the above genotype for develop a new variety/hybrid with desirable resistance, high yield and quality through hybridization and selection. The association analysis carried out in this study revealed that fruit infestation percentage was significantly negative correlation with polyphenol oxidase (-0.68), solasodine (-0.43) and total phenol (-0.49) and positive correlation with total sugars (0.74). The present investigation provided precise information for the selection of important biochemical characters which may contribute more towards resistance to shoot and fruit borer.

Keywords: association, shoot and fruit borer resistance, green brinjal

Introduction

Brinjal (*Solanum melongena* L.) is widely cultivated as one of the most important vegetables in both subtropical and tropical regions of India. It is grown almost in all the districts of Tamil Nadu and extensively in Dindigul, Theni and Madurai districts. In these districts consumers prefer only green coloured fruits than other coloured fruits. Among the major pests infesting the crop, shoot and fruit borer is the most limiting factor distributed all over India, causing heavy yield loss upto 70 per cent (Jat and Pareek, 2003) [7]. Chemical control is widely used means of managing the pest. Repeated use of broad spectrum synthetic chemicals results in environmental contamination, pesticide residue in the produce and destruction of beneficial insects. Host plant resistance (HPR) is the economically sound technique for effective pest management. Various chemical constituents in resistant brinjal varieties were found to play an important role in the antibiosis factor of resistance. Previous research findings was revealed that biochemical characters, such as total sugars and free amino acids, were positively correlated with fruit infestation, whereas, polyphenol oxidase and glycoalkaloids are negatively correlated with fruit borer attack. With this background, an experiment was made for association of biochemical characters in relation to shoot and fruit borer resistance.

Materials and Methods

The present investigation on influence of biochemical characteristics of green fruited brinjal for shoot and fruit borer resistance was carried out in the college orchard, Department of vegetable crops, Faculty of Horticulture, Tamil Nadu Agricultural University, Coimbatore during 2016-2017 which is situated at 11° N latitude and 77° E longitude and at an elevation of 426.6 m above MSL. The experimental materials for the present study consisted of thirty genotypes. Out of thirty genotypes, twelve (IC 261786, IC 354546, IC 111033, IC 090907, EC 316201, EC 315014, IC 249344, IC 354721, IC 383345, IC 454561, IC 310889 and IC 111013) from NBPGR, New Delhi, one (ABSR -2) were received from IIVR, Varanasi, fifteen were collected from local areas (Notchidaipatti, Namakkal, Karur, Patteswaram, Mathukadipattu, Sathirampatti, Kumbakonam, Kurumbapatti, Devachinnampatti, Swamimalai, Ottanchathiram, Andipatti, Thiruchy, Mettupalayam and Musuri) and two (Arka Kusumakar

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and Arka Shirish) from IIHR, Bangalore and evaluated in a randomized block design with two replications. Cultural practices were followed as per the package of practices recommended for Tamil Nadu. The biochemical analysis parameters *viz.*, total phenol, polyphenoloxidase and total sugars were estimated using the procedures described by Sadasivam and Manickam (1992) [11]. The solasodine content was estimated based on the method by Bakshi and Hamied (1972) [2]. The correlation study as per procedure given by Miller *et al.* (1958) [8]. Mean data analysis as suggested by Panse and Sukhetme (1989).

Results and Discussion

Many biochemical factors are known to be associated with

insect pest resistance in crop plants. In many cases, it is obvious that the biochemical constituents like, total phenols, flavonols and enzymes are more important than other morphological and physiological factors, in conferring non-preference and antibiosis. Some biochemical constituents may also act as feeding stimuli for insects.

Mean performance of green genotypes for various biochemical characters

The mean performance of thirty green genotypes for various biochemical characters are presented in table 1. The analysis of variance showed significant difference among the genotypes for four biochemical characters indicating that wide variability observed for all the characters.

Table 1: Mean performance of thirty green fruited brinjal genotypes for various biochemical characters

S. No	Genotypes	Total sugars (mg/g) (FW)	Polyphenol Oxidase (Changes in OD/min/ g of sample)	Solasodine (%)	Total phenol (mg g ⁻¹)
1.	Notchidaipatti local	11.6	0.911	0.042	1.47
2.	ABSR -2	6.5	1.231	0.031	1.59
3.	Namakkal local	8.2	0.521	0.037	1.58
4.	IC 261786	15.3	0.322	0.021	1.37
5.	Karur local	12.1	0.551	0.036	1.42
6.	Pattaswaram local	11.3	0.425	0.052	1.49
7.	Arka Shirish	10.2	0.462	0.048	1.56
8.	Mathukadipattu local	14.6	0.653	0.041	1.45
9.	Sathirampatti local	15.3	0.901	0.046	1.32
10.	Kumbakonam local	12.4	0.820	0.032	1.48
11.	Kurumbapatti local	16.2	0.594	0.035	1.38
12.	Devachinnampatti local	7.3	1.013	0.028	1.58
13.	IC 354546	10.7	0.534	0.023	1.53
14.	IC 111033	9.6	0.217	0.041	1.44
15.	Swamimalai local	9.1	0.325	0.033	1.56
16.	Ottanchathiram local	10.7	0.724	0.042	1.39
17.	IC 090907	7.3	1.002	0.035	1.55
18.	Andipatti local	10.2	0.625	0.046	1.48
19.	EC 316201	8.7	0.812	0.040	1.50
20.	EC 315014	10.3	0.516	0.032	1.42
21.	Arka Kusumakar	9.5	0.936	0.040	1.53
22.	Thirchy local	11.4	0.625	0.054	1.47
23.	Mettupalayam local	12.6	0.418	0.042	1.56
24.	Musuri local	12.4	0.845	0.034	1.40
25.	IC 249344	14.8	0.337	0.020	1.43
26.	IC 354721	18.3	0.213	0.037	1.39
27.	IC 383345	13.6	0.695	0.041	1.42
28.	IC 454561	14.7	0.746	0.036	1.42
29.	IC 310889	15.4	0.539	0.033	1.54
30.	IC 111013	17.2	0.572	0.021	1.36
	Mean	11.98	0.636	0.037	1.47
	SEd	2.218	0.145	0.007	0.048
	CD (0.5)	4.537	0.297	0.015	0.099

The lowest total sugars content (6.5 g g⁻¹ FW) was recorded in highly resistant genotype ABSR-2, while highest (18.3 g g⁻¹ FW) was recorded in susceptible genotype IC 354721. The discoloration in brinjal fruit is attributed to high polyphenol oxidase activity. The highest polyphenol oxidase activity was recorded in the resistant genotype ABSR -2 (1.231 Changes in OD min⁻¹ g⁻¹) and the lowest was recorded in the susceptible genotype IC 249344 (0.213 Changes in OD min⁻¹ g⁻¹). The similar results obtained for polyphenol oxidase by Khorsheduzzaman *et al.* (2010) [12].

A bitter taste and off flavour of brinjal fruits may be produced by higher content of glycoalkaloids in brinjal. The lowest

solasodine content was found in IC 249344 (0.020 %) and the highest solasodine content was measured in Thirchy local (0.054 %). Similar trend was observed by Dhruve *et al.* (2014). Phenols are the extremely abundant plant allelochemicals, often associated with feeding deterrence or growth inhibition of herbivores. The lowest phenol content (1.32 mg g⁻¹) was recorded in the genotype Sathirampatti local and it was high in resistant genotype ABSR -2 (1.59 mg g⁻¹).

Association of biochemical characters on shoot and fruit borer infestation

Table 2: Correlation among various biochemical characters and shoot and fruit borer infestation in green fruited brinjal

	Total Phenol	Total sugars	Polyphenol Oxidase	Solasodine	Fruit infestation (%)
Total phenol	1.000	-0.718**	0.222	0.091	-0.496**
Total sugars		1.000	-0.386*	-0.251	0.734**
Polyphenol Oxidase			1.000	0.096	-0.680**
Solasodine				1.000	-0.430**
Fruit infestation (%)					1.000

*Significant at 5 % level and **Significant at 1 % level

The association between fruit infestation percentage and various biochemical characters and interrelationship among the traits were computed (Table 2).

The fruit infestation percentage showed positive and significant association with total sugars (0.734). Since sugar is considered one of the vital nutrients in plants, the difference in the relative amount of sugars between different genotypes with differential susceptibilities to fruit borer indicate that these compound might act as phago-stimulants to shoot and fruit borer feeding on eggplant. The present results are in agreement with the findings of Jat and Pareek (2003) [7], Elanchezhyan *et al.* (2009) [6] and Prasad *et al.* (2014) [10], who reported that total sugars were positively correlated with fruit infestation. Higher concentration of sugars in eggplant fruits may act as feeding stimulant in the susceptible varieties. Fruit infestation percentage had significant negative correlation with total phenol (-0.496). Phenols in fairly large concentration could ward off insects pests because of their direct toxicity. The genotype with high phenols content showed low percentage infestation, indicating its role in imparting resistance against this pest. The present results are in agreement with Asati *et al.* (2002) [1], Jat and Parrek (2003) [7], Chandrashekhhar *et al.* (2009) [3], Elanchezhyan *et al.* (2009) [6] and Prasad *et al.* (2014) [10] who reported higher phenol contents with increased resistance to fruit borer.

Polyphenol oxidase showed a significantly negative association with per cent fruit borer infestation (-0.680). These findings are in agreement with the findings of Doshi *et al.* (1998) [4] and Khorsheduzzaman *et al.* (2010) [12]. The fruit infestation had significantly negative correlation with solasodine content. Similar correlation for glycoalkaloid content was observed by Doshi *et al.* (1998) [4].

The interrelationship of various biochemical traits showed that total phenol exhibited negative and significant relationship with total sugars (-0.718). Total sugars was negatively and significantly correlated to polyphenol oxidase (-0.386).

The present investigation provided precise information for the selection of important biochemical characters which may contribute more towards resistance to shoot and fruit borer. Occurrence at lower concentration or total absence of such biochemical constituents leads to non-preference, a form of insect resistance. The biochemical characters *viz.*, total sugars, total phenol, polyphenol oxidase and solasodine are important for resistance of plant against shoot and fruit borer.

Conclusion

Out of thirty green brinjal genotypes studied, ABSR-2 recorded low total sugar content, high total phenols and polyphenol oxidase activity resulted in highly resistant to the shoot and fruit borer than the other genotypes. The above genotypes could be used as parents for shoot and fruit borer resistance breeding programmes while selecting suitable varieties or hybrids specific to Dindugal, Theni and Maduari districts in Tamil Nadu.

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