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Seasonal incidence and varietal reaction of different tamarind genotypes (*Tamarindus indica* L.) against fruit borer

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Abstract

An experiment entitled "Varietal reaction of tamarind (*Tamarindus indica* L.) Against fruit borer" was conducted at the Horticulture Nursery Farm, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist.-Ahmednagar (Maharashtra) during season 2021-22. Nineteen genotypes *viz.*, RHRTG-1, RHRTG-2, RHRTG-3, RHRTG-4, RHRTG-5, RHRTG-6, RHRTG-7, RHRTG-8, RHRTG-9, RHRTG-10, RHRTG-11, RHRTG-12, RHRTG-13, RHRTG-14, RHRTG-15, RHRTG-16, RHRTG-17, RHRTG-18 and RHRTG-19, were evaluated in Randomized Block Design (RBD) with two replications. Among these samples collected from fruiting genotypes RHRTG-1, RHRTG-2, RHRTG-4, RHRTG-6, RHRTG-9, RHRTG-14 were evaluated for morphological and for biochemical characteristics of tamarind to study performance against fruit borer resistance. Study of various morphological characteristics revealed that, genotype RHRTG-6 which had minimum curvature length and low content of fibre showed moderate resistance to fruit borer while genotype RHRTG-14 was tolerate recorded maximum curvature length and high content of fibre followed by RHRTG-9. Among all the genotypes, RHRTG-6 which had low content of sugar and high content of tannin, ascorbic acid, and phenol showed moderate resistance to fruit borer. Tolerate genotype was RHRTG-14 followed by RHRTG-9 which had higher content of sugar and lower content of tannin, ascorbic acid, and phenol.

Keywords: Tamarind, fruit borer, seasonal incidence, genotypes, resistance

Introduction

Tamarind (*Tamarindus indica* L.) also known as 'Indian date' is an indigenous tropical fruit tree belongs to family Leguminaceae (Fabaceae) grown in semi-arid and tropical regions of the world. Tamarind is a multipurpose tree and every part of the plant is used for different purposes. Among the various factors responsible for low yield, losses due to insect-pest attack are of prime importance. Tamarind is attacked by more than 40 species of insect pest, although only few of them are of economic importance. In India alone, over 50 insect pests have been recorded as attacking tamarind, causing severe economic losses (Joseph and Oommen, 1960; Senguttuvan, T. 2000) [2, 5]. In pest succession studies, six species of different insect pest *i.e.*, fruit borer, mealy bug, tree hopper, scale insect, hairy caterpillar and bag worm were observed in tamarind crop. Among these, fruit borer, *A. gularis* was categorized as major pest causing 27.95 percent fruit borer infestation/tree (Patel, 2015) [3].

Singh (2014) [7] reported fruit borer *Cryptopphlebia ombrodelta* as a major pest of tamarind and bael at eastern India. The damage of borer started at green fruit stage and went up almost till the maturity of fruit. The sap suckers also cause major damage, which affect the tender shoots and fresh foliage. The most destructive among these are white flies, thrips, coccids and aphids. The defoliators, which include caterpillars and beetles, can also cause considerable damage. Some of these insects attack the flower buds and the developing fruits and seeds, while others damage the fruits during storage. Some of the most serious pests in India are the hard-scale insects (*Aonidiella orientalis*, *Aspidiotus destructor* and *Saisetia oleae*) (Patil, 2005) [4].

Although host plant resistance biochemicals such as phenol, tannin, etc. have attained considerable momentum recently and have attracted the attention of scientists in evolutionary ecology, entomology, plant physiology, and biotechnology, much of the underlying mechanism has still remained unanswered. There is a need to understand the insect-specific signal molecules, their identification, mode of action, and further signal transduction pathways.

Since a single attribute can affect insects and natural enemies positively or negatively, understanding the multitrophic interactions is important to know the consequences of the supposed defensive traits of a plant for use in pest management. Since the biochemical pathways that lead to induced resistance are highly conserved among plants, elicitors of these pathways could be used as inducers in many crops. The future challenge is to exploit the elicitors of defense induction in plants for pest management and identify the genes encoding proteins that are up- or down-regulated during plant response to the insect attack, which can be deployed for conferring.

Materials and Methods

Field experiment was conducted at the Horticulture Nursery Farm, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist.: Ahmednagar (Maharashtra) during season 2021-22. Nineteen genotypes *viz*., RHRTG-1, RHRTG-2, RHRTG-3, RHRTG- 4, RHRTG-5, RHRTG-6, RHRTG-7, RHRTG-8, RHRTG-9, RHRTG-10, RHRTG-11, RHRTG-12, RHRTG-13, RHRTG-14, RHRTG-15, RHRTG-16, RHRTG-17, RHRTG-18 and RHRTG-19, were evaluated in Randomized Block Design (RBD) with two replications. Among these RHRTG-1, RHRTG-2, RHRTG-4, RHRTG-6, RHRTG-9, RHRTG-14 samples collected from fruiting genotypes were evaluated for morphological and for biochemical characteristics of tamarind to study performance against fruit borer resistance. The biochemical characteristics such as total sugar, phenol, ascorbic acid, tannin was estimated as per the Standard procedures. (Thimmaiah, 1999) [9].

Table 1: Scale to categorize genotypes resistance for fruit borer

Fruit borer infestation damage %	Category
0	Immune
0-10	Fairly resistant
11-20	Moderately resistant
21-30	Tolerant
31-40	Susceptible
40 above	Highly susceptible

Scale to categorize genotypes resistance for fruit borer developed by Seram and Devi (2021) [6] to categorize the resistance was used for quantitative assessment of the fruit resistance inflicted by the fruit borer.

Results and Discussion

Effect of morphological characteristics of tamarind genotypes on fruit borer resistance

Weight of tamarind fruit ranged between 17.35-28.6 gm. Highest fruit weight was observed in genotype RHRTG-6 (28.6 gm) followed by RHRTG-1 (22.56) as shown in table-2 which had lowest incidence of fruit borer whereas maximum incidence observed in genotype RHRTG-14 with lowest fruit weight (17.6 gm). Mean fruit borer incidence was negatively correlated with the weight of fruit with correlation coefficient (r) of -0.562 as shown in table-3. Range of weight of shell of tamarind fruit was 4.2-6.61 gm. Highest weight of fruit shell was observed in genotype RHRTG-6 (6.61 gm) followed by RHRTG-1 (5.9 gm) which had lowest occurrence of fruit borer population. However, RHRTG-4 (4.2 gm) as shown in table-2 recorded lowest weight of fruit shell followed by RHRTG-14 (5.1 gm). From this study, we can conclude that weight of fruit shell was negative correlation with fruit borer incidence with correlation coefficient (r) value of -0.674 as shown in table-3. In various genotypes observed, length of fruit ranged between 11.8-15.5 cm. Longest fruit length was recorded in genotype RHRTG-6 (15.7 cm) as shown in table-2 recorded lowest incidence of fruit borer whereas maximum incidence observed in genotype RHRTG-14 (11.8 cm) which had shortest fruit length. Mean fruit borer incidence was negatively correlated with the length of fruit with correlation coefficient (r) value of -0.735 as shown in table-3. Among all genotypes observed, curvature length of fruit ranged between 3.0-8.3 cm. Shortest length of fruit curvature was recorded in genotype RHRTG-6 (2 cm) which had lowest average population of fruit borer.

Whereas, maximum curvature length of fruit was recorded in genotype RHRTG-4 (8.3 cm) followed by RHRTG-14 (6 cm) which had maximum incidence of fruit borer. Mean fruit borer incidence was positively correlated with the curvature length of fruit with correlation value (r) of 0.420 as shown in table-3. Range of weight of pulp of tamarind fruit was 11.24-16.08gm as shown in table 2. Highest pulp content recorded in genotype RHRTG-6 (17gm) which showed lowest incidence of fruit borer and genotype RHRTG-14 (11.24 gm) showed highest incidence of fruit borer with lowest pulp content. It was observed that weight of pulp showed negative correlation with fruit borer incidence having correlation coefficient (r) of -0.640 as shown in table-3. In all genotypes observed, seed weight of fruit ranged between 4.37-6.5 gm. Highest weight of seed was observed in genotype RHRTG-6 (6.5 gm) as shown in table-2 which had lowest incidence of fruit borer whereas maximum incidence observed in genotype RHRTG-14 (4.37 gm) with lowest seed weight. From this, we concluded that mean fruit borer incidence was negatively correlated with the seed weight of fruit with correlation value (r) of -0.658 as shown in table-3. Weight of fibre ranged between 1.15-1.24 gm. Lowest weight of fruit fibre was recorded in genotype RHRTG-2 (1.15 gm) followed by RHRTG-6 (1.18 gm). However, RHRTG-9 recorded highest weight of fruit fibre (1.24 gm) followed by RHRTG-14 (1.2 gm). It was revealed that weight of fruit fibre had positive correlation with fruit borer incidence with correlation value (r) of 0.505 as shown in table-3.

Study of various morphological characteristics revealed that, genotype RHRTG-6 which had minimum curvature length and low content of fibre showed moderate resistance to fruit borer. While genotype RHRTG-14 was highly susceptible recorded maximum curvature length and high conent of fibre followed by RHRTG-9. Haldhar *et al.* (2021) [1] reported in jamun, fruit length, fruit width and pulp: stone ratio ranged between 1.54 to 2.60 cm, 1.30 to 2.93 cm, 0.14 to 0.53 cm and 0.60 to 2.47 ratio, respectively that parameters are lowest in genotypes of jamun which are resistant to fruit borer, *Meridarchis scyrodes* and *Dudua aprobola*. This results are in support of present findings.

Effect of biochemical characteristics of tamarind genotypes for fruit borer resistance: After analyzing total sugar percentage of various genotypes samples by Anthrone reagent method, it was observed that the total sugar percentage in different genotypes varied from 20.67 to 22.21. The lowest total sugar percentage (20.67%) was obtained in genotype RHRTG-6 followed by genotype RHRTG 2 (20.88%) as shown in table-4 whereas the highest total sugar percentage (22.21%) was obtained in genotype RHRTG-14 followed by genotype RHRTG 9 with total sugar percentage of 21.50%. The minimum average population of fruit borer was observed in genotype RHRTG-6 (6.82 mean fruit borer larvae/tree) followed by genotype RHRTG 2 (8.77 fruit borer larvae/tree). Therefore, total sugar percentage was significantly positively correlated against the incidence of fruit borer with correlation coefficient values (r) of 0.832 as shown in table-5. Total phenol content eastmated by Folin-Ciocalteu Reagent (FCR) method and it was observed that the total phenol content in different genotypes varied in the range of 179 to 240 mg GAE/100 gm. The highest phenol content was obtained in genotype RHRTG-6 (240 mg GAE 100 g^{-1}) followed by the genotype RHRTG 2 (221 mg GAE $100g^{-1}$) as shown in table-4. Whereas, the lowest phenol content was obtained in genotype RHRTG-14 (179 mg GAE 100 g^{-1}) followed by genotype RHRTG 9 (185 mg GAE 100 g^{-1}). The minimum average population of fruit borer was observed in genotype RHRTG-6 (6.82 fruit borer larvae/tree). Therefore, the data obtained from the analysis of total phenol percentage revealed that phenol content was significantly negatively correlated against fruit borer infestation with correlation value (r) of -0.977 as shown in table - 5. Total ascorbic acid content of various genotypes was evaluated by volumetric method. Total ascorbic acid content in different genotypes varied from 4.6 to 8 mg per 100 g as shown in table-4. Lowest fruit borer incidence was recorded from genotype RHRTG-6 (8 mg per 100g) mean fruit borer larvae/tree) which had highest ascorbic acid content. While, the genotype RHRTG-14 had lowest content of ascorbic acid (4.6 mg per 100 g) which recorded highest incidence of fruit borer (10.59 mean fruit borer larvae/tree). We could conclude that ascorbic acid content was negatively corelated with the mean fruit borer incidence with correlation value (r) of -0.770 as shown in table-4.

Tannin (mg per gram) evaluated from various genotypes by using Folin-Denis method ranged from 260.13 to 273.30 mg per gram. In analysis, genotype RHRTG-6 recorded highest tannin content (280.12 mg per gram) as shown in table-4 along with the minimum fruit borer incidence (6.82 mean fruit borer larvae/tree). It was followed by the genotype RHRTG 2 with tannin content 278.80 mg per gram. Contradictory to this RHRTG-14 had maximum fruit borer incidence (10.59 mean larvae/tree) with lowest tannin content (260.13 mg per gram) followed by RHRTG 9 (263.40 mg per gram). Tannin content was negatively significantly correlation coefficient value (r) of -0.879 as shown in table-5.

Among the genotypes, RHRTG-6 which had low content of sugar and high content of tannin, ascorbic acid, and phenol showed moderate resistance to fruit borer. Highly susceptible genotype was RHRTG-14 foloowed by RHRTG-9 which had higher content of sugar and lower content of tannin, ascorbic acid, and phenol. Singh *et al.* (2018) [7] evaluated total phenol content in jack fruit and revealed that total phenol content was higher in resistant accession and had significant negative correlation with shoot and fruit borer *Diaphania caesalis*. These results suggested that a combination of these biochemical attributes like phenol may contribute to plant resistance, which might be used as marker in selection of resistant jack fruit sources against the target pest. These findings are in support of current findings. Haldhar *et al.* (2021) [1] reported that total phenol content ranged from 18.75 to 38.06 mg/100gm and tannin content ranged from 22.47 to 53.33 mg/100gm that where highest in jamun genotypes which were resistant to fruit borer M*eridarchis scyrodes* and *Dudua aprobola* and lowest in susceptible genotypes which are in support of present findings.

Table 2: Effect of Morphological characteristics on seasonal incidence of Fruit borer on tamarind during, 2021-2022

Genotypes	Survived Mean larval fruit borer infestation per m2 of twigs	Mean % fruit borer incidence	Weight of fruit (gm)	Weight of Shell (gm)	Fruit length (cm)	Curvature of fruit (cm)	Weight of pulp (gm)	Seed weight of fruit	Weight of fibre (gm)
RHRTG-1	9.55	22.00 (27.89)	25.26	5.9	15.5	3.0	16.08	6.45	1.16
RHRTG-2	8.77	21.00 (27.19)	18.35	5.6	14.0	4.0	15.5	5.1	1.15
RHRTG-4	9.73	23.38 (28.83)	17.35	4.2	12.0	8.3	11.24	4.5	1.21
RHRTG-6	6.82	14.00 (21.90)	28.6	6.61	15.7	2.0	17.0	6.5	1.18
RHRTG-9	10.45	27.00 (31.22)	24.3	5.5	13.0	2.3	13.0	5.2	1.24
RHRTG-14	10.59	29.00 (32.50)	17.6	5.1	11.8	6.0	14.5	4.37	1.2
S.E ±	-	0.25	-	-	-	-	-	-	-
C.D at 5%	-	0.75	-	-	-	-	-	-	-

Figures in the parenthesis are arcsine transform.

Table 3: Correlation coefficient (r) of Morphological characteristics against fruit borer incidence

Morphological characteristics	Correlation Coefficient of value (r)
Weight of fruit (g)	-0.562
Weight of shell (g)	-0.674
Fruit length (cm)	-0.735
Curvature of fruit (cm)	0.420
Weight of pulp (g)	-0.640
Seed weight of fruit	-0.658
Weight of fibre (g)	0.505

*Significant at 5% level of significance (Table value = 0.812 at 4 d.f.) ** Significant at 1% level of significance (Table value = 0.917 at 4 d.f.)

Table 4: Effect of Biochemical parameters on seasonal incidence of Fruit borer on tamarind during season, 2021-2022

Genotypes	Survived Mean larval fruit borer infestation per m2 of twigs	Mean % fruit borer incidence	Total Sugar (%)	Phenol (mg GAE 100/g)	Ascorbic Acid mg per 100 g	Tannin mg per 100 g
RHRTG-1	9.55	22.00 (27.89)	21.09	203	6.3	613.30
RHRTG-2	8.77	21.00 (27.19)	20.88	221	7.1	615.80
RHRTG-4	9.73	23.38 (28.83)	21.33	199	5.9	605.12
RHRTG-6	6.82	14.00 (21.90)	20.67	240	8.0	620.12
RHRTG-9	10.45	27.00 (31.22)	21.50	185	5.1	600.40
RHRTG-14	10.59	29.00 (32.50)	22.21	179	4.6	597.13
S.E ±	-	0.25	-	-	-	-
C.D at 5%	-	0.75	-	-	-	-

Figures in the parenthesis are arcsine transform.

Table 5: Correlation coefficient (r) of Biochemical characteristics against fruit borer incidence

Biochemical characteristics	Correlation Coefficient of value (r)
Total sugar (%)	0.832*
Phenol mg GAE $100g^{-1}$	-0.977**
Ascorbic acid (%)	-0.770
Tannin (mg g^{-1})	-0.878*

*Significant at 5% level of significance (Table value = 0.812 at 4 d.f.) ** Significant at 1% level of significance (Table value = 0.917 at 4 d.f.)

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References
1. Haldhar SM, Singh AK, Singh D, Berwal MK, Gora JS, Kumar R, Sarolia DK. Endogenous effect of *Syzygium cumini* genotypes on incidence of fruit borers, *Meridarchis scyrodes* and *Dudua aprobola*. J Environ. Biol. 2021-2022;43:585-592.
2. Joseph KV, Oommen P. Notes on some insect pests infesting dry tamarind fruits in Kerala State. Ind. J of Entomol. 1960;22(3):172-180.
3. Patel RK. Studies on insect pests of tamarind, *Tamarindus indica* L. with special reference to fruit borer, *Aphomia gularis* Zeller in Bastar region of Chhattisgarh survey, insect pests, tamarind, *Tamarindus indica* L., fruit borer, *Cryptophlebia ombrodelta* Lower, bastar plateau, plains, Chhattisgarh, M.Sc. (agri.) thesis submitted to IGKV, Raipur; c2015. p. 52-55.
4. Patil NK. Studies on losses of tamarind fruit and possibility of implementation of safe storage technique. M.Sc. thesis submitted to Indira Gandhi Krishi Vishwavidyala, Raipur; c2005. p. 47-49.
5. Senguttuvan T. Insect pest associated with three semi-arid fruits under agroforestry. Insect Environment. 2000;6(2):78.
6. Seram D, Devi YK. Insect resistance screening techniques and scoring for important horticultural crops. Plant Cell Biotechnology and Molecular Biology. 2021;22(33-34):155-162.
7. Singh HS. Record of *Cryptophlebia ombrodelta* (Lower) (Tortricidae: Lepitoptera) on Bael (*Aegle marmelos*) and tamarind (*Tamarindus indica* L.) in eastern India. Insect Environment. 2014;20(1):24-25.
8. Singh P, Jyoti J, Reddy PVR, Shivashankara KS. Biochemical basis of host-plant resistance to shoot and fruit borer, *Diaphania caesalis* Wlk. in jackfruit (*Artocarpus heterophyllus* Lam.). Pest Management in Horticultural Ecosystems. 2018;24(1):8-14.
9. Thimmaiah SK. Standard Methods of Biochemical Analysis, Kalyani Publishers, New Delhi; c1999. p. 296-299.