



## Assessment of Host Plant Resistance in Brinjal against Major Sucking Pests

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**ABSTRACT:** Brinjal (*Solanum melongena* L.) is widely cultivated in tropical and subtropical regions worldwide and is attacked by several insect pests. An experiment was conducted to screen 20 brinjal genotypes against the major sucking pests, namely aphids (*Aphis gossypii*), jassids (*Amrasca biguttula biguttula*), and whitefly (*Bemisia tabaci*). The results indicated that the genotypes NDB-23-10 and NDB-23-7 recorded the lowest infestation levels. Resistance was largely associated with dense trichomes and higher phenolic content. The identified lines can be used in hybridization programmes to develop cultivars resistant to major sucking pests of brinjal, thereby reducing reliance on chemical pesticides for pest management.

**Keywords:** Breeding, genotype, resistance, *Solanum melongena*, sucking insect pests

### INTRODUCTION

Brinjal (*Solanum melongena* L.) is an important fruit vegetable cultivated widely in tropical and subtropical regions. It is grown extensively in India, Bangladesh, Pakistan, China, Japan, the Philippines, France, Italy and the USA. India ranks second globally in brinjal production and productivity, next to China. In India, brinjal occupies about 8.0 per cent of the total vegetable area (approximately 7.30 lakh hectares) and contributes nearly 8.1 per cent to total vegetable production, accounting for around 12.70 million tonnes during 2020–21 (Anonymous, 2019; NHB, 2021). It is a key solanaceous vegetable rich in proteins, minerals, vitamins, dietary fibre and polyphenols, and is reported to help against obesity, cancer, ageing, diabetes, inflammation and neurological disorders, while also supporting healthy complexion, hair and improved energy (Praveen and Mallikarjunarao, 2020).

Among the biotic stresses limiting brinjal production, insect pests remain one of the most important constraints reducing yield. The crop is attacked by about 140 species of insect and non-insect pests (Frepong, 1979; Pandey *et al.*, 2022a; Pandey *et al.*, 2022b). However, brinjal suffers major losses primarily due to shoot and fruit borer (*Leucinodes orbonalis* Guen.), whitefly (*Bemisia tabaci* Genn.), jassids (*Amarasca biguttula biguttula*

Ishida), aphids (*Aphis gossypii* Glover), brinjal mite (*Tetranychus cinnabarinus* Biosd) and nematodes. Among these, sucking pests such as aphids, jassids and whiteflies cause serious damage by extracting cell sap from leaves and other tender plant parts. Both nymphs and adults appear from early crop stages and persist until harvest. Aphid infestation causes the lower leaf surface to curl and bend backward. Jassid nymphs and adults inject toxic saliva during feeding (Joshi *et al.*, 2022; Pandey *et al.*, 2023), resulting in stunting and leaves that curl, turn yellow and develop a cup-like appearance, often with brownish or reddish margins. Whitefly infestation leads to wrinkling, downward curling and eventual leaf shedding. In addition to direct feeding injury, aphids and whiteflies secrete honeydew that promotes sooty mould growth. Depending on infestation intensity, yield losses due to sucking pests range from 10 to 15 per cent (Chatterjee *et al.*, 2018; Dubey *et al.*, 2022).

For insect pest control, farmers largely depend on chemical pesticides (Divekar *et al.*, 2022). Host plant resistance (HPR) is considered one of the most suitable, economical and eco-friendly strategies, as it adversely affects pest survival and other biological parameters (Divekar *et al.*, 2019; Dubey *et al.*, 2020). The use of resistant cultivars is a core component of bio-intensive pest management and provides an environmentally sound

and cost-effective approach to pest suppression. Several studies have screened brinjal cultivars against insect pests in different regions of India. However, cultivars available in a specific region must also be evaluated, and efforts are required to understand the biochemical basis of resistance in selected entries (Elanchezhyan *et al.*, 2008).

Both biochemical and morphological plant traits contribute significantly to resistance by reducing pest preference and performance through effects on movement, feeding, oviposition and development. However, in field conditions, it is often difficult to separate mechanisms of resistance because of strong genotype  $\times$  environment interactions. Therefore, detailed laboratory-based studies are needed to understand resistance mechanisms in brinjal cultivars (Kasting and Ginnis, 1961). With this background, the present investigation was carried out to screen brinjal genotypes and identify elite sources of resistance.

## MATERIALS AND METHODS

The experiment was carried out at the Department of Entomology, Department of Plant Physiology and the Main Experimental Station (Horticulture), located on the main campus of the university on the left side of the Ayodhya- Raebareli Road, about 42 km from the Ayodhya district headquarters. The study was conducted during the Rabi season of 2023-24. Twenty brinjal genotypes were used as experimental material, collected from the Department of Vegetable Science. Seeds of the genotypes were raised in a polyhouse to obtain seedlings for transplantation. Seedlings were transplanted at 4-6 weeks of age when they had 4-5 true leaves. The plot size was 3.0  $\times$  2.5 m, with a spacing of 50 cm between rows and 50 cm between plants, and a gap of 0.10 m between rows to facilitate operations such as watering and weeding. During field preparation, 10-15 tonnes of well-decomposed manure per hectare were applied to enrich the soil. At transplanting, the full dose of phosphorus (50-60 kg P<sub>2</sub>O<sub>5</sub>/ha) was applied as DAP and potassium (50-60 kg K<sub>2</sub>O/ha) as MOP. Nitrogen was applied at 100-120 kg N/ha as urea. Weed management was critical during the first 30-45 days, with manual weeding performed 20-30 days after planting. Water management was also important, as brinjal requires 600-1200 mm water during the growing season, with special attention during establishment, flowering and fruit development. The experiment was laid out in a Randomized Block Design (RBD) with three replications.

## Screening for sucking pests aphid (*A. gossypii*), jassids (*A. bigutella bigutella*) and whitefly (*B. tabaci*)

The number of nymphs and adults of aphid (*A. gossypii*), jassids (*A. bigutella bigutella*) and whitefly (*B. tabaci*) were recorded on three leaves (one each from bottom, middle and top canopy) from five randomly selected plants. Each leaf was examined carefully during early morning hours. Population was expressed as number per three leaves, following Dahatonde *et al.* (2014).

## Biophysical parameters

Biophysical parameters such as plant height (cm), shoot thickness (2.5 cm below tip), number of primary and secondary branches, leaf length and width (cm), trichome density on three leaves (upper, middle and lower canopy) on both upper and lower leaf surfaces within 25 mm<sup>2</sup> using a stereomicroscope, calyx length (cm), number of fruits per plant, fruit length (cm), fruit shape and fruit colour were recorded following Dahatonde *et al.* (2014). Trichome density was recorded at 30 DAT, while number of calyxes per fruit, fruit diameter, fruit shape, petiole length, number of fruits, and leaf length and width were recorded at 70 DAT. Population was expressed as number per three leaves as described by Dahatonde *et al.* (2014). Observations were recorded across genotypes and replications and mean values were computed.

## Biochemical parameters

Biochemical parameters included estimation of chlorophyll by acetone method (Arnon, 1949). Total phenols were estimated using Folin-Ciocalteu reagent. Total protein was estimated by the method of Lowry *et al.* (1951), based on protein hydrolysis and amino acid estimation. Peroxidase (POD) activity (donor: H<sub>2</sub>O<sub>2</sub>-oxidoreductase) was assayed using guaiacol as substrate (Putter, 1974; Malik *et al.*, 1980). Reducing sugars were estimated using the dinitrosalicylic acid method, which is simple, sensitive and suitable for handling large sample numbers (Krishnaveni *et al.*, 1984; Miller, 1972).

## Statistical analysis

Statistical analysis was carried out following Gomez and Gomez (1984). Critical difference (CD) was calculated to test significance of treatment means at the 5% level. Data transformation included and arcsine transformation for pest population and per cent infestation data, respectively.

Table 1. Screening of certain brinjal genotypes against sucking pests

Genotypes	Aphid ( <i>Aphids gossypii</i> /three leaves)	Whitefly ( <i>Bemisia tabaci</i> /three leaves)	Jassids ( <i>Amrasca bigutulla bigutulla</i> / three leaves)
NDB-23-1	10.68±0.53	9.38±0.47	9.30±0.46
NDB-23-2	19.08±0.76	10.52±0.42	9.73±0.39
NDB-23-3	12.34±0.74	12.17±0.73	8.78±0.53
NDB-23-4	17.28±1.38	17.81±1.42	8.85±0.71
NDB-23-5	24.99±0.75	16.21±0.49	13.15±0.39
NDB-23-6	10.81±0.43	12.51±0.50	11.94±0.48
NDB-23-7	29.55±1.48	21.96±1.10	19.29±0.96
NDB-23-8	9.28±0.56	11.11±0.67	9.80±0.59
NDB-23-9	10.52±0.74	10.13±0.71	9.52±0.67
NDB-23-10	26.23±2.10	13.92±1.11	13.16±0.49
NDB-23-11	11.13±0.45	12.17±0.49	12.26±1.25
NDB-23-12	20.26±1.62	19.82±1.59	15.67±1.25
NDB-23-13	10.06±0.91	14.26±1.28	16.04±1.44
NDB-23-14	13.53±0.81	14.01±0.84	12.15±0.73
NDB-23-15	10.75±0.54	10.77±0.54	10.40±0.52
NDB-23-16	7.86±0.47	7.01±0.42	6.16±0.37
NDB-23-17	12.66±0.76	10.06±0.60	11.15±0.67
NDB-23-18	10.21±0.61	10.93±0.66	11.61±0.70
NDB-23-19	12.01±0.72	11.01±0.66	8.52±0.51
NDB-23-20	20.25±1.21	10.61±0.64	10.57±0.63
<b>C.D</b>	<b>1.66</b>	<b>1.40</b>	<b>1.23</b>
<b>C.V</b>	<b>6.70</b>	<b>6.63</b>	<b>6.53</b>
<b>SEM±</b>	<b>0.58</b>	<b>0.49</b>	<b>0.43</b>
<b>P-VALUE</b>	<b>S</b>	<b>S</b>	<b>S</b>
<b>D.F</b>	<b>59.00</b>	<b>59.00</b>	<b>59.00</b>

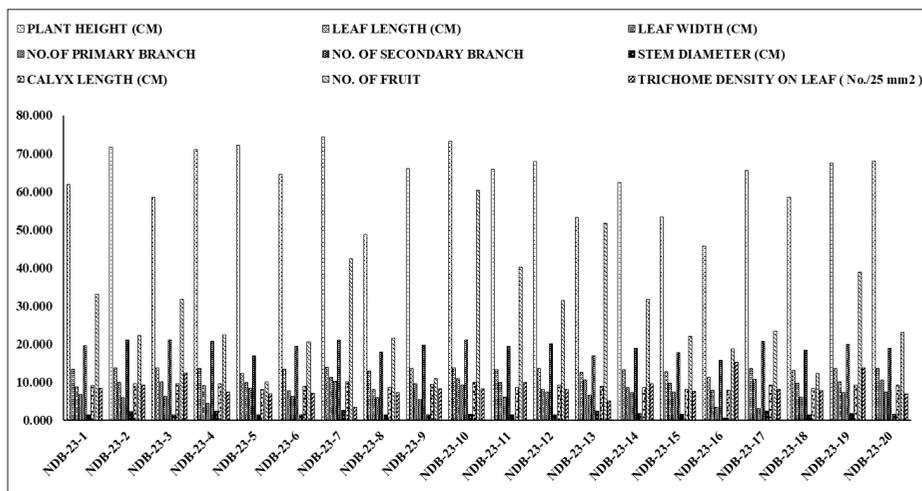


Fig.1: Morphological basis of resistance in brinjal genotypes against major pests of brinjal

**Determination of correlation coefficient:** Correlation between major insect pests and abiotic factors was calculated using the formula.

$$R = \frac{\sum dndy}{Nn \sqrt{\frac{\sum d^2xi}{N} \times \frac{\sum d^2y}{N}}}$$

Where, Y = insect population; xi = biophysical and biochemical parameters N = number of observations;  $\Sigma$  = summation

## RESULT AND DISCUSSION

### Identification of resistant sources of brinjal against aphid (*A. gossypii*)

Among the brinjal genotypes screened, the highest aphid population per three leaves was recorded on NDB-23-7 ( $29.55 \pm 1.48$ /three leaves) (Table 1), followed by NDB-23-10 ( $26.23 \pm 2.10$ /three leaves), NDB-23-5 ( $24.99 \pm 0.75$ /three leaves), NDB-23-12 ( $20.26 \pm 1.62$ /three leaves) and NDB-23-20 ( $20.25 \pm 1.21$ /three leaves). The lowest aphid population was observed on NDB-23-16 ( $7.86 \pm 0.47$ /three leaves), followed by NDB-23-8 ( $9.28 \pm 0.56$ /three leaves), NDB-23-13 ( $10.06 \pm 0.91$ /three leaves), NDB-23-18 ( $10.21 \pm 0.61$ /three leaves) and NDB-23-1 ( $10.68 \pm 0.53$ /three leaves).

### Identification of resistant sources of brinjal against whitefly (*B. tabaci*)

Among the screened genotypes, the lowest whitefly population per three leaves was recorded in NDB-23-16 ( $7.01 \pm 0.42$ ), whereas the highest was recorded in NDB-23-7 ( $21.96 \pm 1.10$ /three leaves) (Table 1). Higher infestations were also observed on NDB-23-13 ( $19.82 \pm 1.59$ /three leaves), NDB-23-5 ( $17.81 \pm 1.42$ /three leaves), NDB-23-6 ( $16.21 \pm 0.49$ /three leaves) and NDB-23-14 ( $14.26 \pm 1.28$ /three leaves). Lower whitefly populations were recorded on NDB-23-16 ( $7.01 \pm 0.42$ /three leaves), NDB-23-1 ( $9.38 \pm 0.47$ /three leaves), NDB-23-10 ( $10.13 \pm 0.71$ /three leaves), NDB-23-2 ( $10.52 \pm 0.42$ /three leaves), NDB-23-20 ( $10.61 \pm 0.64$ /three leaves) and NDB-23-17 ( $10.77 \pm 0.54$ /three leaves).

### Identification of resistance sources of brinjal against jassids (*A. bigutella bigutella*)

Among the genotypes screened, the lowest jassid population per three leaves was recorded in NDB-23-16 ( $6.16 \pm 0.37$ /three leaves), while the highest was recorded in NDB-23-7 ( $19.29 \pm 0.96$ /three leaves)

(Table 1). Higher infestation levels were also observed on NDB-23-13 ( $16.04 \pm 1.44$ /three leaves), NDB-23-12 ( $15.67 \pm 1.25$ /three leaves), NDB-23-10 ( $13.16 \pm 0.49$ /three leaves) and NDB-23-5 ( $13.15 \pm 0.39$ /three leaves). Lower jassid populations were recorded on NDB-23-19 ( $8.52 \pm 0.51$ /three leaves), NDB-23-3 ( $8.78 \pm 0.53$ /three leaves), NDB-23-1 ( $9.30 \pm 0.46$ /three leaves), NDB-23-9 ( $9.52 \pm 0.67$ /three leaves) and NDB-23-2 ( $9.73 \pm 0.39$ /three leaves).

### Biophysical basis of resistance in brinjal genotypes against major pests of brinjal

Substantial variation was observed among genotypes for plant height. NDB-23-7 recorded the maximum height ( $74.29 \pm 3.71$  cm), followed by NDB-23-10 ( $73.09 \pm 5.85$  cm) and NDB-23-5 ( $72.14 \pm 2.16$  cm), whereas NDB-23-16 recorded the minimum height ( $45.74 \pm 2.74$  cm), which was 1.62 times lower than NDB-23-7 ( $74.29 \pm 3.71$  cm). NDB-23-7 recorded the maximum leaf length ( $13.99 \pm 0.70$ ), followed by NDB-23-13 ( $12.66 \pm 1.14$ ), NDB-23-15 ( $12.69 \pm 0.63$ ) and NDB-23-5 ( $12.29 \pm 0.37$ ), while NDB-23-16 recorded the minimum leaf length ( $11.29 \pm 0.68$ ). The minimum leaf width was recorded in NDB-23-6 ( $7.81 \pm 1.65$  cm), while NDB-23-16 recorded the maximum leaf width ( $11.32 \pm 1.08$  cm). Primary branches varied from NDB-23-7 ( $10.33 \pm 0.52$ ) to NDB-23-16 ( $3.11 \pm 0.19$ ). Secondary branches ranged significantly, with NDB-23-7 recording the maximum ( $21.07 \pm 1.05$ ) and NDB-23-16 recording the minimum ( $15.79 \pm 0.95$ ). NDB-23-7 recorded the maximum stem diameter ( $2.56 \pm 0.13$  cm), whereas NDB-23-16 recorded the minimum diameter of ( $45.74 \pm 2.74$ ) cm. Calyx length was highest in NDB-23-7 ( $10.02 \pm 0.50$ ) and lowest in NDB-23-16 ( $7.95 \pm 0.48$ ). Number of fruits per plant ranged from  $42.33 \pm 2.12$  in NDB-23-7 to  $18.81 \pm 1.13$  in NDB-23-16. Fruit length was maximum in NDB-23-7 ( $21.31 \pm 1.07$  cm) and minimum in NDB-23-11 ( $8.88 \pm 0.36$ ). Fruit width was maximum in NDB-23-7 ( $7.45 \pm 0.37$  cm) and minimum in NDB-23-13 ( $4.06 \pm 0.36$ ). Trichome density on leaves ranged from NDB-23-7 ( $3.50 \pm 0.17$ ) to NDB-23-16 ( $15.20 \pm 0.91$ ) (Fig. 1).

### Biochemical basis of resistance in brinjal genotypes on major insect pests

Total chlorophyll content was lowest in NDB-23-2 ( $1.59 \pm 0.22$  mg/g) and highest in NDB-23-20 ( $5.13 \pm 0.72$  mg/g). Protein content was lowest in NDB-23-3 ( $0.69 \pm 0.16$  mg/g) and highest in NDB-23-16 ( $1.275$  mg/g). Reducing sugar content was lowest in NDB-23-

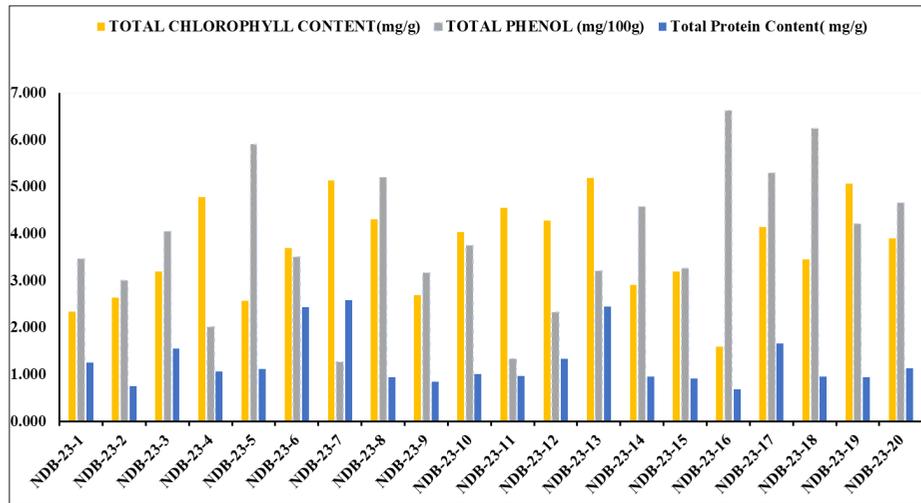


Fig.2: Biochemical bases of resistance in brinjal genotypes against major pests of brinjal

Table 2. Correlation between biophysical parameters and sucking pests in brinjal genotypes

Biophysical Parameters	Aphid ( <i>Aphids gossypii</i> /three leaves)	Whitefly ( <i>Bemisia tabaci</i> /three leaves)	Jassids ( <i>Amrasca bigutulla bigutulla</i> / three leaves)
Plant height (cm)	0.771**	0.535*	0.380
Leaf length (cm)	0.389	0.334	0.260
Leaf width (cm)	0.652**	0.461*	0.419
No. of primary branch	0.682**	0.566**	0.646**
No. of secondary branch	0.403	0.321	0.144
Stem diameter (cm)	0.374	0.468*	0.471*
Calyx length (cm)	0.499*	0.380	0.278
No. of fruit	0.275	0.306	0.451*
Fruit Length (cm)	0.324	0.457*	0.625**
Fruit Width (cm)	0.588**	0.643**	0.540*
Trichome density on leaf (No./25 mm <sup>2</sup> )	-0.443	-0.555*	-0.728**

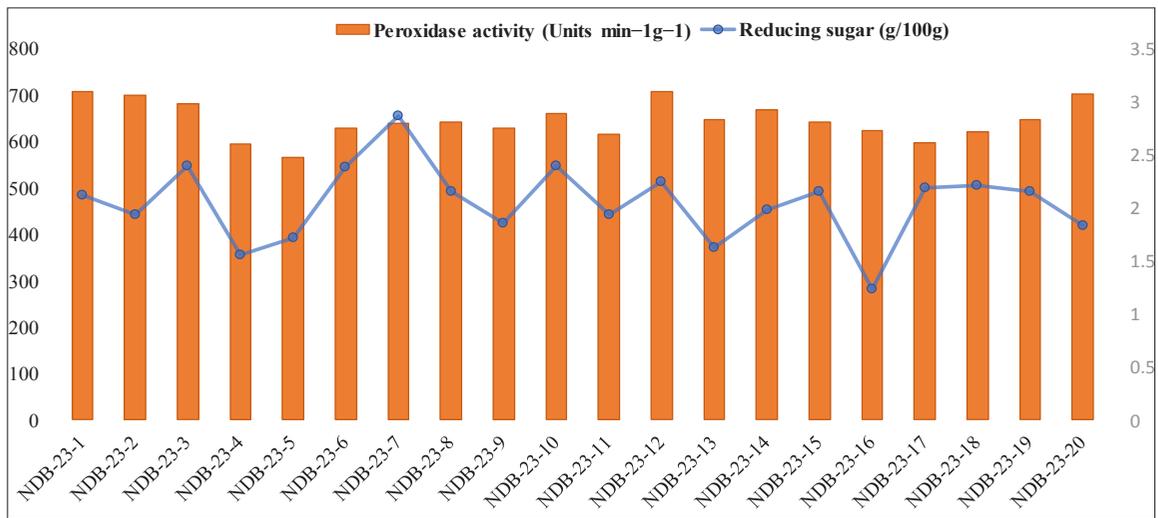
16 (1.23 ± 0.108 mg/100 g) and highest in NDB-23-7 (2.87 ± 0.1435 mg/100 g). Peroxidase activity was lowest in NDB-23-5 (567.47 ± 117 unit min<sup>-1</sup> g<sup>-1</sup>) and highest in NDB-23-1 (709.17 ± 8.65 unit min<sup>-1</sup> g<sup>-1</sup>). Phenolic content was minimum in NDB-23-10 (1.27 ± 0.02 mg/g) and maximum in NDB-23-8 (6.63 ± 0.44 mg/g) (Figure 2 & 3).

**Correlation of major insect pests of brinjal with biophysical and biochemical parameters**

**Aphid, *A. gossypii***

Aphid population showed a highly significant positive correlation with plant height (r = 0.771\*\*), fruit width (r

= 0.588\*\*), number of primary branches (r = 0.682\*\*) and leaf width (r = 0.652\*\*). It showed non-significant positive correlation with leaf length (r = 0.389), number of secondary branches (r = 0.403), stem diameter (r = 0.374), number of fruits (r = 0.275), fruit length (r = 0.324), total protein (r = 0.396) and total carbohydrate (r = 0.410). Aphids showed significant positive correlation with calyx length (r = 0.499\*) and peroxidase activity (r = 0.545\*), while trichome density showed a non-significant negative correlation (r = -0.443). Total phenol showed non-significant negative correlation (r = -0.291), whereas total chlorophyll (r = 0.225) and reducing sugar (r = 0.347) showed non-significant positive correlations (Table 2 and 3).



**Fig.3: Biochemical bases of resistance in brinjal genotypes against major pests of brinjal**

**Table 3. Correlation between biochemical parameters and sucking pests in brinjal genotypes**

Biochemical parameters	Aphid ( <i>Aphids gossypii</i> /three leaves)	Whitefly ( <i>Bemisia tabaci</i> /three leaves)	Jassids ( <i>Amrasca bigutulla bigutulla</i> / three leaves)
Total Protein Content (mg/g)	0.396	0.474*	0.661**
Total carbohydrates (mg/ml)	0.410	0.488*	0.426
Total phenol (mg/g)	-0.291	-0.546*	-0.439
Total Chlorophyll content(mg/g)	0.225	0.535*	0.523*
Peroxidase (units min <sup>-1</sup> g <sup>-1</sup> .)	0.545*	0.491*	0.498*
Reducing sugar (g/100g)	0.347	0.368	0.487*

**Whitefly, *B. tabaci***

Whitefly population showed positive correlation with plant height ( $r = 0.535^*$ ), and non-significant positive correlation with leaf length ( $r = 0.334$ ), number of secondary branches ( $r = 0.403$ ), stem diameter ( $r = 0.374$ ), number of fruits ( $r = 0.275$ ) and reducing sugar ( $r = 0.368$ ). Significant positive correlation was observed with leaf width ( $r = 0.461^*$ ), while highly significant positive correlation was recorded with number of primary branches ( $r = 0.682^{**}$ ), fruit width ( $r = 0.643^{**}$ ), calyx length ( $r = 0.499^*$ ), fruit length ( $r = 0.457^*$ ), chlorophyll content ( $r = 0.535^*$ ) and peroxidase activity ( $r = 0.491^*$ ). Whitefly population was significantly negatively correlated with trichome density ( $r = -0.555^*$ ) and total phenol ( $r = -0.546^*$ ) (Table 2; Table 3).

**Jassids, *A. bigutulla bigutulla***

Jassid population showed non-significant positive correlation with plant height ( $r = 0.380$ ), leaf length ( $r =$

$0.260$ ), calyx length ( $r = 0.278$ ), leaf width ( $r = 0.419$ ), and number of secondary branches ( $r = 0.144$ ). It showed significant positive correlation with stem diameter ( $r = 0.471^*$ ), number of fruits ( $r = 0.451^*$ ), total chlorophyll ( $r = 0.523^*$ ), reducing sugar ( $r = 0.487^*$ ) and peroxidase activity ( $r = 0.498^*$ ). Highly significant positive correlation was recorded with number of primary branches ( $r = 0.646^{**}$ ), total protein ( $r = 0.661^{**}$ ) and fruit length ( $r = 0.625^{**}$ ), while trichome density showed a highly significant negative correlation ( $r = -0.728^{**}$ ) (Table 2 and 3). The present findings are closely in agreement with Gautam *et al.* (2018), who reported that none of the tested varieties were free from aphid infestation and aphid populations ranged from 19.4 to 42.6 on number basis. Variety Ananya was less susceptible, followed by Kiran, BR-112 and Nano-38, whereas Local Deshi was highly susceptible, followed by Green Star and Qayamat. Jafr *et al.* (2018) also reported significant variation among brinjal genotypes against aphids, with maximum population on “AB-317” (0.2222) and minimum on “AD F1-320”

(0.0444). The results are also in line with Salve *et al.* (2019), who reported *A. bigutulla bigutulla* populations ranging from 0.25 to 10.12 jassids/3 leaves/plant and identified JKJEH-6012 (3.15), Utkal Keshri (3.24) and Pusa Upkar (3.71) as least infested cultivars. Berani *et al.* (2020) reported that GJLB-4 (1.72 per leaf/plant) and Surati Ravaiya (1.96 per leaf/plant) recorded lower jassid populations, whereas GJB-2 recorded the highest (11.88 per leaf/plant). Dahatonde *et al.* (2014) reported that among fourteen brinjal genotypes, AB-8/6 recorded the lowest whitefly population (5.93 whiteflies/three leaves), and several other genotypes were statistically at par with relatively low infestations. Plant structure and complexity such as leaf shape, hairiness and plant height can influence whitefly oviposition and feeding preferences (Basu, 1995; Butter and Venkatesha, 2012). Secondary metabolites including phenolics, terpenoids and alkaloids in brinjal leaves can deter feeding or act as toxins (Leatemia and Isman, 2004; Murugan and Uthamasamy, 2001). Nutrient levels such as nitrogen and amino acids can influence whitefly attraction, feeding and reproduction (Bi *et al.*, 2001; Tsagkarakou *et al.*, 2002). Volatile organic compounds released by brinjal plants, including terpenes and green leaf volatiles, may also attract or repel whiteflies (Bleeker *et al.*, 2009; Murugan and Uthamasamy, 2001).

## CONCLUSION

Among the 20 brinjal genotypes screened, lower infestation of major sucking pests was observed in NDB-23-10 and NDB-23-7, whereas higher infestation was observed in NDB-23-16 and NDB-23-9, indicating these as contrasting genotypes. The anatomical characters studied in the selected genotypes suggest that plant height, leaf width, leaf length, stem diameter, calyx length, number of fruits, fruit length, fruit width, number of primary branches and number of secondary branches play important roles in resistance. Biochemical traits contributed strongly to antixenosis, and antibiosis studies also indicated that biochemical parameters were important. Phenols adversely affected survival of sucking pests, whereas proteins and sugars showed a positive influence. Overall, the results on resistance mechanisms clearly indicate that genotypes NDB-23-7 and NDB-23-10, with dense trichomes, higher phenols, lower reducing sugars and lower proteins, can be used in hybridization programmes to develop cultivars resistant to major insect pests of brinjal.

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## AUTHORS CONTRIBUTION

PB – conceptualisation, Methodology, analysis, writing the original draft,; SKS, KRS, VKD, SKT, AKS and VK – Supervision, editing and correcting final manuscript.

## CONFLICT OF INTEREST

No potential conflict of interest was reported by the author(s).

## REFERENCES

- Anonymous. 2019. Data published by Ministry of Agriculture, Govt. of India. <http://www.indiastat.com>. (Accessed on 11.12.2024).
- Arnon, D.I. 1949. Copper enzymes in isolated chloroplasts: polyphenol oxidases in *Beta vulgaris*. *Plant Physiology*, **24**: 1–14.
- Basu, A.N. 1995. *Bemisia tabaci* (Gennadius): crop pest and principal whitefly vector of plant viruses. New Delhi: Aditya Books Private Limited.
- Bi, J.L., Toscano, N.C. and Madore, M.A. 2001. Amino acid composition in honeydew from symbiont-cured and symbiont-harboring *Bemisia argentifolii* (Homoptera: Aleyrodidae) whiteflies. *Annals of the Entomological Society of America*, **94**(3): 420-426.
- Bleeker, P.M., Diergaarde, P.J., Ament, K., Guerra, J., Weidner, M., Schütz, S. and Schuurink, R.C. 2009. The role of specific tomato volatiles in tomato-whitefly interaction. *Plant Physiology*, **151**(2): 925-935.
- Butter, N.S. and Ananda Venkatesha, B. 2012. Host Plant Resistance to Insects. In Basic and Applied Aspects of Biopesticides. Springer. pp. 121-137.
- Chatterjee, S., Kundu, S.S., Chettri, D. and Mukhopadhyay, A.K. 2018. Population dynamics of sucking pests in the brinjal ecosystem under the new Gangetic alluvial zone. *Journal of Entomology and Zoology Studies*, **6**(5): 2157-2161.
- Choudhary B. 1970. Vegetables. National Book Trust, India, New Delhi. pp. 25-50.

- Dahatonde, J.A, Pandya, H.V, Raut, S.B. and Patel, S.D. 2014. Screening of some genotypes of brinjal for their relative resistance against jassid and whitefly. *Asian Journal of Bio Science*, **9**: 137-38.
- Divekar, P.A., Kumar, P. and Suby, S.B. 2019. Screening of maize germplasm through antiobiosis mechanism of resistance against *Chilo partellus* (Swinhoe). *Journal of Entomology and Zoology Studies*, **7**: 1111-1114.
- Divekar, P.A., Narayana, S., Divekar, B.A., Kumar, R., Gadratagi, B.G., Ray, A. and Behera, T.K. 2022. Plant secondary metabolites as defense tools against herbivores for sustainable crop protection. *International Journal of Molecular Sciences*, **23**(5): 2690.
- Dubey, V. K., Kallelshwaraswamy, C. M., Joshi, S. and Shivanna, B.K. 2022. Diversity and diagnostics of Sternorrhynchan insect pests infesting Arecanut. *Indian Journal of Entomology*, **84**(3): 509-515.
- Dubey, V.K., Shivanna, B.K. and Kallelshwaraswamy, C.M. 2020. Neem oil based formulation is effective for the management of whitefly, *Aleurocanthus arecae* David & Manjunatha and wax scale, *Chrysomphalus aonidum* (Linnaeus) on arecanut. *Pest Management in Horticultural Ecosystems*, **26**(2): 235-239.
- Elanchezhyan, K., Baskaran, R.K. and Rajavel, D.S. 2008. Field screening of brinjal varieties on major pests and their natural enemies. *Journal of Biopesticides*, **1**(2): 113-120.
- Frepong, E. 1979. The nature of damage to eggplant in Ghana by two important pests, *Leucinodes orbonalis* G. and *Ezophere vilore* Bull. *De Institute Fundamental d Afrique*. **41**: 408-416.
- Gautam, S., Tomar, S. P. S., Singh, P. D., Suryawanshi, D. K. and Singh, U. C. 2019. Screening of brinjal (*Solanum melongena* L.) varieties against insect pest complex. *International Journal of Agriculture Sciences*, **11**(7):8180–8182.
- Jafir, M., Shehzad, M., Abbas, Q., Ahmad, J. N., Aslam, A., Ali, Y., Aftab, M. and Javed, M. W. 2018. Germplasm screening of brinjal (*Solanum melongena* L.) cultivars for resistance to sucking insect pests. *Journal of Entomology and Zoology Studies*, **6**(1):1134–1137.
- Joshi, S., Gupta, A., Shashank, P.R., Pai, S. G., Mohan, M., Rachana, R.R. and Deepthy, K.B. 2022. Recent adventive soft scale insects (Hemiptera: Coccoomorpha: Coccidae) and mealybugs (Hemiptera: Coccoomorpha: Pseudococcidae) in India. *Zootaxa*, **5194**(2): 213-252.
- Kasting, R. and Mc. Ginnis, A.J. 1961. Comparison of tissue from solid and hollow stemmed spring wheats during growth. *Canadian Journal of Zoology*, **39**: 273-280.
- Krishnaveni, S., Balasubramanian, T. Sadasivam, S. 1984. Sugar Distribution in Sweet Stalk Sorghum. *Food Chemistry*, **15**:229-232.
- Leatemia, J. A. and Isman, M. B. 2004. Insecticidal activity of crude seed extracts of *Annona* spp. on *Callosobruchus maculatus* (F.) (Col.: Bruchidae) in cowpea. *International Journal of Tropical Insect Science*, **24**(3), 258-264.
- Lowry, O.H. Rosebrough, N.J. Farr, A.L. and Randall, R.J. 1951. Protein measurement with folinphenol reagent. *Journal of Biological Chemistry*, **193**: 265–275.
- Miller, G.L. 1972. Use of Dinitrosalicylic Acid Reagent for Determination of Reducing Sugars. *Analytical Chemistry*, **31**: 426-428.
- Murugan, K. and Uthamasamy, S. 2001. Solanum xanthocarpum: a plant with insecticidal properties. *Journal of Scientific & Industrial Research*, **60**(4): 276-285.
- Muthukrishnan, N., Subramanian, S. and Premalakshmi, V. 2015. Biochemical basis of resistance in brinjal (*Solanum melongena* L.) genotypes to shoot and fruit borer (*Leucinodes orbonalis* Guenée). *Pest Management in Horticultural Ecosystems*, **21**(1): 1-7.
- National Horticulture Board, Ministry of Agriculture & Farmers Welfare, Government of India. 2021. Area and Production of Horticulture Crops for 2020-21.
- Pandey, A., Agrawal, M. and Agrawal, S.B. 2022a. Ultraviolet-B induced modifications in growth, physiology, essential oil content and composition of a medicinal herbal plant *Psoralea corylifolia*. *Horticulture, Environment, and Biotechnology*, **63**(6): 917-934.

- Pandey, A., Agrawal, M. and Agrawal, S.B. 2023. Individual and combined effects of chromium and ultraviolet-B radiation on defense system, ultrastructural changes, and production of secondary metabolite psoralen in a medicinal plant *Psoralea corylifolia* L. *Environmental Science and Pollution Research*, **30**(2): 4372-4385.
- Pandey, A., Jaiswal, D., Agrawal, M. and Agrawal, S.B. 2022b. Changes in ultrastructure, photosynthetic abilities, and secondary metabolite due to individual and interactive effects of chromium and ultraviolet-B radiation in *Adhatoda vasica*. *Photosynthetica*, **61**(2): 157.
- Praveen, S.L. and Mallikarjunarao, K. 2020. Assessment of biophysical and biochemical bases of resistance in brinjal against major insect pests. *Journal of Pharmacognosy and Phytochemical*, **9**(2S): 428-433.
- Salve, R.S., Sonkamble, M.M. and Patil, S.K. 2020. Screening of brinjal varieties for resistance to major insect pests. *Journal of Entomology and Zoology Studies*, **8**(1): 1484-1489.
- Tsagkarakou, A., Navajas, M., Papayannakis, N. and Pastou, C. 2002. Genetic differentiation in *Bemisia tabaci* (Homoptera: Aleyrodidae) insects from Greece and other Mediterranean regions. *Biochemical Genetics*, **40**(11-12): 559-571.

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