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Morphological basis of resistance against thrips (*Scirtothrips dorsalis* Hood) infesting Chilli [*Capsicum annum* L.]

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Abstract
Investigation was carried out on "Morphological basis of resistance against thrips (*Scirtothrips dorsalis* Hood) infesting chilli [*Capsicum annum* L.]" at Instructional Farm, ASPEE College of Horticulture and Forestry, Regional Horticultural Research Station, Navsari Agricultural University, Navsari during 2018-19. The results revealed that, maximum thickness of leaf lamina (1.24 µm) and minimum leaf area (12.16 cm^2) were recorded in chilli variety GVC-111 which in turn had moderate number of thrips (3.34/3 leaves). Significantly maximum internode length (11.03 cm), number of branches per plant (6.87), number of leaves per plant (56.87), number of fruits per plant (66.33) and plant height (51.33 cm) were recorded in GAVC hybrid-1 (51.33 cm) which in turn had moderate number of thrips (3.80/3 leaves). On the contrary, minimum days to flower initiation was recorded in GVC-121 (40.47 days) where in thrips population was minimum (2.89/3 leaves). Highly significant and negative correlation (r=-0.836) was found between number of thrips per leaves and number of fruits per plant while, remaining morphological parameters failed to exhibit any significant correlation with thrips population.

Keywords: Thrips, *Scirtothrips* dorsalis Hood, chilli, *Capsicum annum* L.

Introduction

Chilli (*Capsicum annum* L.) is a member of *solanaceae* family which represents a diverse plant group. The name is derived from Latin word "Capsa" that means "hallow pod". There are various biotic and abiotic factors responsible for reducing in yield of chilli. The insect pests being the major which in over 25 insects have been recorded attacking leaves and fruits of chilli in India, of which thrips (*Scirtothrips dorsalis* Hood), aphid (*Aphis gossypii* Glover) and mite (*Polyphagotarsonemus latus* Banks) are the considerable and important pests (Butani, 1976) [3]. In Gujarat, thrips, aphid, cutworm, whitefly and mites have been reported to infest the chilli crop. Thrips is one of the most serious pests causing about 60.5 to 74.3 percent yield loss of green chilli and considered as an important enemy of chillies. Thrips are also responsible for transmission of leaf curl disease locally known as "*kokadva*". Both nymphs and adult thrips cause damage by scraping and lacerating leaf epidermis and suck the cell sap from leaves resulting in margin of the leaves rolled upwards and the leaf size reduced. In extreme conditions, the leaf colour turns bronze with sharp reduction in plant height. The yield loss due to chilli thrips ranges from 50-90 percent (Bagle, 1998) [1].

Although, insecticidal interventions bring down the pest damage but on the other hand lead to problem of pesticide residues in fruits (Joia *et al.*, 2001) [5]. The presence of pesticide residues in spices, especially in chillies is a major non-tariff barrier against export to developed countries. Similarly, indiscriminate use of insecticides has led to insecticide resistance, pest resurgence and environmental pollution besides upsetting the natural ecosystem (Singh and Kumar, 1998) [12]. Abundant literature is available on life history, feeding habit and control measures of thrips however, work on morphological basis of resistance against thrips infesting chilli is not much available hence, attempts were made to have comprehensive information on morphological basis of resistance against thrips.

Materials and Methods

Present investigation on "Morphological basis of resistance against thrips (*Scirtothrips dorsalis* Hood) infesting chilli [*Capsicum annum* L.]" was carried out at Instructional Farm, Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during late *kharif* 2018-19. Experimental materials for the present investigation consisting of varieties of chilli (GVC-101, GVC-111, GVC-121, GAVC-112, AVNPC-131, GAVC hybrid-1) were obtained from the Main Vegetables Research Station, Anand Agricultural University, Anand and (GCH-1, GCH-3) from Spices Research Station Jagudan, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. Eight varieties were grown in randomized block design replicated thrice. The varieties under test were kept unsprayed throughout the crop period and all other recommended agronomical practices were followed for raising the chilli crop. When thrips crossed ETL (3 nymphs or adults/leaf), three leaves of each chilli varieties were brought to Agricultural Chemistry and Soil Science laboratory of NMCA, Navsari. Chilli damage leaves samples were kept in marked brown paper bags having wax coated inner side and were brought to the laboratory for studying morphological variations of chilli with respect to the damage by thrips.

Methodology adopted for observation

Thickness of leaf lamina: In order to measure the thickness of the leaf lamina, three leaves were randomly collected from each variety. Thickness of leaf lamina was measured by using ocular micrometer under binocular microscope by taking cross section of leaf lamina with the help of fine razor blade.

Leaf area: Leaf area was measured by using leaf area meter in cm^2.

Internode length: The same five plants of each variety were taken for measuring internode length using simple linear scale. In total, three replications were observed

Number of branches per plant: Number of branches per plant were counted in each tagged plant. Thus, total all the three replications were observed.

Number of leaves per plant: Number of leaves per plant were counted in each tagged plant. In total, three replications were observed and in each replication five selected plants were observed.

Number of fruits per plant: Total number of fruits comprising of both healthy and infested per plant selected earlier were counted in each picking and the total number of fruits per five selected plants per variety were determined which represented unit replicate.

Plant height: The plant height of various varieties was recorded from five selected plants per variety per replication. Thus, each replication represented five selected plants from three replications.

Days to flower initiation: Days to flower initiation were recorded by counting days from date of transplanting to first flower initiation on the selected five plants in each plot and average values were worked out.

Results and Discussion

For morphological characters of chilli varieties in relation to thrips population

The results (Table 1) revealed significant variation among chilli varieties in terms of morphological traits and their association with thrips infestation. The variety GVC-121 recorded the lowest thrips population (2.89/3 leaves), accompanied by moderate leaf thickness (1.05 µm) and longer internode length (9.80 cm), suggesting that such structural features may hinder pest colonization. Similarly, GVC-111, having the maximum lamina thickness (1.24 µm) and the lowest leaf area (12.16 cm²), also showed a lower thrips population (3.34), indicating the importance of leaf toughness and reduced surface area in deterring thrips. On the contrary, GCH-3, with the thinnest lamina (1.03 µm) and the largest leaf area (16.52 cm²), recorded the highest thrips population (6.07), supporting the view that softer and broader leaves provide a favorable microenvironment for thrips feeding and multiplication, as also reported by Patil *et al.* (2014) [9] and Bhosle *et al.* (2011) [2]. GAVC hybrid-1, despite having maximum internode length (11.03 cm), highest number of branches (6.87), leaves (56.87), fruits (66.33), and plant height (51.33 cm), maintained a moderate thrips level (3.80), suggesting that vigorous plant architecture and better canopy may help reduce thrips pressure by improving airflow and unfavorable microclimates, which agrees with Yadav *et al.* (2013) [13]. Varieties like AVNPC-131 and GCH-1, which had fewer branches, shorter plants, and weaker growth, recorded higher thrips populations (5.16 and 5.61, respectively), indicating that poor vegetative traits are associated with higher susceptibility, as observed by Kamble *et al.* (2016) [6]. Early flowering in GVC-121 (40.47 days) was linked with low thrips incidence, while late flowering in AVNPC-131 (46.73 days) corresponded to high thrips count, suggesting that early flowering may allow escape from peak pest infestation, a mechanism supported by Choudhary and Patel (2017) [4]. Furthermore, a strong and significant negative correlation (r =-0.836) between thrips population and number of fruits per plant confirms that increased thrips infestation adversely affects fruit set and yield, which is consistent with findings of Singh *et al.* (2010) [11] and Sharma *et al.* (2015) [10], who reported reduced productivity in chilli due to thrips-induced flower and fruit damage.

Correlation study of morphological characters of chilli varieties and their relationship with thrips population

Highly significant and negative correlation (r=-0.836) was found between number of thrips per leaves and number of fruits per plant while, remaining morphological parameters failed to exhibit any significant correlation with thrips population (Table 2). In past, Megharaj *et al.* (2016) [8] reported that thrips incidence had negative and significant correlation with fruit yield (r=-0.233), number of fruits per plant (r=-0.325), number of primary branches per plant (r=-0.314). From the present investigation it was observed that chilli varieties with thickness of leaf lamina, plant height, internode length, number of branches per plant and number of leaves per plant had non-significant and negative correlation with thrips population. Leaf area and day to flower initiation had non-significant and positive correlation with thrips population. It implies that with increase in leaves area and day to flower initiation there was corresponding increase in thrips population and vice-versa. Latha and

Hunumanthraya (2018) [7] found that trichome density was significant and negatively correlated with population of thrips. The maximum fruit yield of chilli was also obtained in the DCC-3, 109, 185 followed by DCC-89. In the current investigation, the varieties having higher thrips population registered lower fruit yield which is also reported in the above reports thus confirm the ongoing discussion.

Table 1: Morphological characters of chilli varieties in relation to thrips population

Varieties	Population of thrips	Morphological characters							
		Thickness of leaf lamina (µm)	Leaf area (cm^2)	Internode length (cm)	Number of branches/plant	Number of leaves/plant	Number of fruits/plant	Plant height (cm)	Days to flower initiation
GVC-101	4.25	1.17	13.62	8.40	5.67	48.73	59.80	44.33	44.53
GVC-111	3.34	1.24	12.16	7.13	5.07	45.33	60.07	43.33	43.73
GVC-121	2.89	1.05	15.71	9.80	6.27	52.13	61.67	47.60	40.47
GAVC-112	4.70	1.20	12.78	10.87	6.80	55.47	62.47	48.40	41.47
AVNPC-131	5.16	1.08	15.37	6.07	4.47	42.07	49.50	45.87	46.73
GAVC hybrid-1	3.80	1.14	14.63	11.03	6.87	56.87	66.33	51.33	42.13
GCH-1	5.61	1.14	14.78	6.13	4.33	41.07	46.93	37.60	44.40
GCH-3	6.07	1.03	16.52	6.00	4.30	38.47	43.87	36.07	42.73
S. Em±	0.13	0.02	0.52	0.42	0.18	2.23	2.73	1.34	0.85
C D at 5%	0.39	0.05	1.58	1.27	0.55	6.77	8.27	4.08	2.58
C V (%)	10.10	2.71	6.26	8.90	5.78	8.14	8.39	5.25	3.40

Table 2: Correlation study of morphological characters of chilli varieties and their relationship with thrips population

	Correlation coefficient (r)							
	Thickness of leaf lamina (µm)	Leaf area (cm^2)	Internode length (cm)	Number of branches/plant	Number of leaves/plant	Number of fruits/plant	Plant height (cm)	Days to flower initiation
Population of thrips	-0.316	0.393	-0.596	-0.632	-0.656	-0.836**	-0.676	0.438

** Significant at 1 percent level (r =±0.834)

Conclusion

The study clearly indicates that morphological traits of chilli varieties significantly influence thrips infestation. Varieties like GVC-111 and GAVC hybrid-1, which possessed traits such as thicker leaf lamina, lower leaf area, longer internodes, more branches and leaves per plant, and greater plant height, exhibited lower to moderate thrips populations. In contrast, GCH-3, with thin leaf lamina, larger leaf area, shorter internodes, fewer branches, and reduced plant height, consistently recorded higher thrips infestation. A strong negative correlation (r = -0.836) between thrips population and number of fruits per plant highlights the detrimental effect of thrips on yield. Hence, selecting chilli varieties with favorable morphological features can be a potential strategy in integrated pest management for minimizing thrips incidence and maximizing chilli productivity.

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