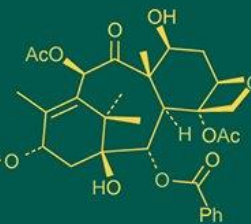
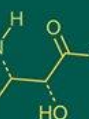
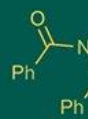


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Species-specific tolerance patterns against major sucking pests in chilli (*Capsicum* spp.) under protected cultivation

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Abstract

Protected cultivation provides a favourable environment for year-round production of chilli, but it also promotes the incidence and multiplication of sucking pests, including thrips, mites, and whiteflies. Identifying naturally tolerant genotypes from diverse germplasm offers an environmentally sustainable strategy for pest management. Twenty chilli genotypes belonging to three species, namely *Capsicum annum*, *C. chinense*, and *C. frutescens*, were evaluated under polyhouse conditions in two seasons to investigate species-specific tolerance to major sucking pests. Pest reactions were observed and recorded based on the characteristic damage symptoms of each pest, and a Chi-square test of independence was performed to assess the association between resistance patterns and species. Significant associations were observed between species and reaction to thrips, mites and whiteflies. Resistance to thrips and mites was mainly associated with *C. chinense* and *C. frutescens*, whereas resistance to whiteflies was predominantly associated with *C. annum*. These findings suggest that sucking pest tolerance in chilli is species-influenced.

Keywords: Sucking pests, thrips, mites, whiteflies and chi-square test

Introduction

Protected cultivation systems offer controlled environmental conditions that support year-round cultivation, enhanced productivity and improved fruit quality. By regulating environmental factors such as temperature, light, wind speed and humidity, protected structures help in stable crop growth and increased economic returns (Kumar & Kumar, 2018; Singh *et al.*, 2024; Jain *et al.*, 2025) [7, 14, 5]. However, these conditions are also favourable for the rapid multiplication of sucking insect pests, especially mites, thrips, and whiteflies, which pose a major threat to chilli production (Yadav *et al.*, 2022) [15]. These pests cause significant damage to crops by sucking plant sap, reducing photosynthetic efficiency, deforming leaves and fruits, and transmitting several viral pathogens, ultimately affecting yield and quality. Management of sucking pests in protected cultivation is mainly achieved through repeated application of chemical pesticides. Although it is effective in the short term, excessive application of pesticides has resulted in increased production costs, the development of pesticide-resistant pest populations, the disruption of beneficial insects, and the presence of pesticide residues in harvested produce (Logeswaran *et al.*, 2023) [8]. Consequently, identification and deployment of host plant resistance have gained considerable attention as a sustainable component of integrated pest management strategies. Resistant cultivars reduce dependence on chemical inputs while contributing to environmentally safe and economically viable crop production (Sharma *et al.*, 2019) [12]. The genus *Capsicum* exhibits wide genetic diversity, which is mainly expressed through variation in plant morphology, fruit characteristics, adaptation to different environments and resistance to biotic and abiotic stresses (Colonna *et al.*, 2019) [3]. Differences among cultivated *Capsicum* species in their susceptibility to sucking pests have been attributed to variations in morphological characteristics such as trichomes, biochemical constituents, and underlying genetic factors (Barik *et al.*, 2025) [1]. Despite the availability of diverse germplasm, information on species-level variation in resistance to sucking pests is still limited. With this background, the present investigation was carried out to assess the response of different *Capsicum* species to the major sucking pests, namely thrips, mites and whiteflies, under polyhouse conditions.

Materials and Methods

The present experiment was carried out at the Instructional Farm of Kerala Agricultural University, Thrissur, in a naturally ventilated polyhouse for two seasons from August, 2024 to January, 2025 and from March, 2025 to August, 2025. A total of 20 chilli (*Capsicum* spp.) genotypes comprising 11 accessions of *C. annuum*, five *C. chinense* and four *C. frutescens* were used in the investigation. The experiment was conducted in a Completely Randomised Design (CRD) with two replications. All recommended management practices were followed to ensure healthy crop growth (KAU, 2025) [6]. Pest response was evaluated through visual observation of characteristic damage symptoms associated with each pest (Fig. 1). Thrips infestation was recognised by the presence of upward curling of leaves, while mite damage was identified by downward leaf curling together with the characteristic rat-tail appearance of the foliage (Rai *et al.*, 2009; Singh and

Singh, 2013; Dey *et al.*, 2024) [10, 13, 4]. Whitefly infestation was recorded based on the presence of whiteflies on the underside of leaves, honeydew deposits on leaves and leaf chlorosis (Senanayake *et al.*, 2012; Yadav *et al.*, 2022) [11, 15]. Based on the observed symptoms, each genotype was categorised as either resistant or susceptible to each of the three sucking pests during the flowering stage. Chi-square (χ^2) test of independence was performed to analyse the association between *Capsicum* species and pest response. For the analysis, genotypes belonging to *C. annuum* were considered as one species group, whereas *C. chinense* and *C. frutescens* were combined into a second group because these were genetically closely related (Carvalho *et al.*, 2014) [2]. Resistance status (resistant or susceptible) served as the second categorical variable in the contingency analysis. Statistical significance was determined at the 5% probability level ($P < 0.05$).

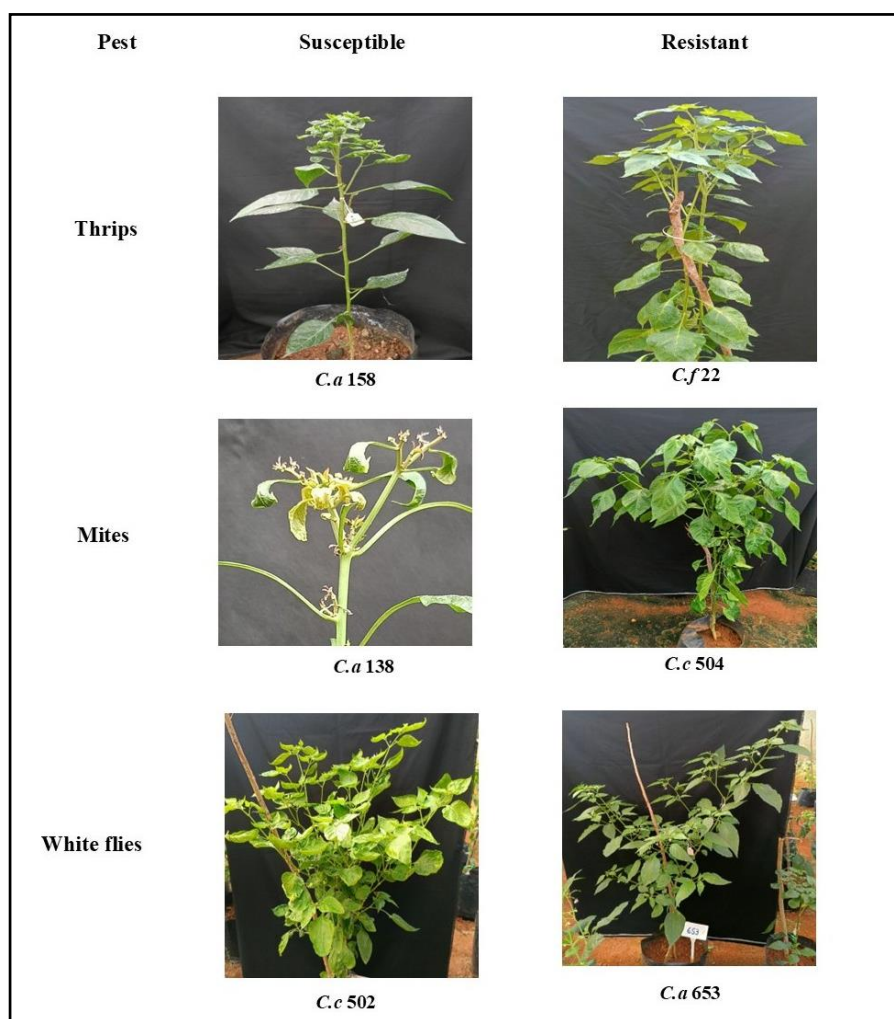


Fig 1: Comparative response of chilli accessions to thrips, mites, and whiteflies

The accession number is given below each figure (C.a-*Capsicum annuum*, C.c-*Capsicum chinense* and C.f-*Capsicum frutescens*)

Results and Discussion

The Chi-square (χ^2) test of independence analysis revealed that species background significantly influenced the response of chilli genotypes to thrips, mites and whiteflies (Table 1), indicating that pest tolerance is closely associated with genetic background.

A major proportion of genotypes resistant to thrips belonged to the *C. chinense*-*C. frutescens* group, whereas the majority of *C. annuum* genotypes were susceptible. But the genotype C.a. 653 has shown significant resistance to all three sucking pests, such as thrips, mites and whitefly. Thrips are one of the most devastating pests because they feed on tender plant tissues, resulting in leaf curling, deformation of young foliage and reduced plant growth. Thrips may also act as vectors for viruses in chilli (Dey *et al.*, 2024) [4]. The resistance expressed by *C. chinense* and *C. frutescens*

suggests that these species possess natural defence mechanisms that restrict thrips infestation and multiplication (Barik *et al.*, 2025) ^[1].

Similar to the trend observed for thrips, resistant genotypes to mites were mainly identified in *C. chinense* and *C. frutescens*, while a higher proportion of susceptible genotypes occurred in *C. annuum*. The consistent resistance exhibited by *C. chinense* and *C. frutescens* against both thrips and mites suggests that these species may possess common defence mechanisms that protect against multiple sucking pests. These mechanisms may include structural barriers that hinder pest establishment or constitutive biochemical compounds that reduce pest survival and reproduction (Sharma *et al.*, 2019) ^[12].

In contrast to thrips and mites, the pattern of resistance to whiteflies differed considerably among species. Resistant genotypes to whiteflies were predominantly represented by *C. annuum*. Whiteflies reduce crop performance through continuous sap extraction, induction of leaf chlorosis and deposition of honeydew, which encourages the development of sooty mould and limits photosynthesis (Parisi *et al.*, 2020) ^[9]. The higher frequency of resistant genotypes within *C. annuum* indicates that the genetic basis of whitefly resistance differs from that governing resistance to thrips and mites. This contrasting response demonstrates that defence against sucking pests is highly pest-specific, and resistance to one pest cannot necessarily be expected to confer protection against another. Therefore, breeding strategies targeting multiple pests should consider the specific resistance profile of each donor parent.

Table 1: Association between *Capsicum* species and resistance to major sucking pests under protected cultivation as revealed from chi-square test of independence.

Attribute	Chi-square (χ^2) value	P-value
Reaction to thrips and species	9.7306	0.0018
Reaction to mites and species	7.5000	0.0062
Reaction to whiteflies and species	7.2128	0.0072

Conclusion

The study revealed significant species-specific variation in tolerance to major sucking pests under protected cultivation. *C. chinense* and *C. frutescens* exhibited significantly higher tolerance to thrips and mites, whereas *C. annuum* demonstrated higher tolerance to whiteflies. The significant Chi-square associations confirm that pest response is strongly influenced by species background. These species can therefore serve as valuable donor parents in breeding programmes aimed at developing pest-tolerant chilli morphotypes suitable for protected cultivation.

References

- Barik S, Mahankuda B, Sahu N, Mohapatra S, Sridhar V, *et al.* Thrips and mites in peppers: challenges and resistance strategies. *Euphytica*. 2025;221:82.
- Carvalho SIC, Ragassi C, Bianchetti LDB, Ribeiro CDC, Reifschneider F, Buso G, *et al.* Morphologic and genetic relationships between wild and domesticated forms of peppers (*Capsicum frutescens* and *Capsicum chinense*). *Genetics and Molecular Research*. 2014;13(3):7447-7464.
- Colonna V, D'Agostino N, Garrison E, Albrechtsen A, Meisner J, Facchiano A, *et al.* Genomic diversity and novel genome-wide association with fruit morphology in *Capsicum*, from 746k polymorphic sites. *Scientific Reports*. 2019;9(1):10067.
- Dey S, Mandal I, Nandi R. Management of black thrips in chilli in India: a review. *International Journal of Entomology Research*. 2024;9(9):39-43.
- Jain S, Jain S, Singh L, Raghavan M, Vimal VK, Shaifali, *et al.* Impact of protected cultivation on growth, yield and quality of fruits, vegetables and flowers. *International Journal of Environmental Sciences*. 2025;11(6):244-252.
- Kerala Agricultural University. Package of practices recommendations: crops. 15th ed. 2025.
- Kumar S, Kumar R. Protective cultivation: a review. *Journal of Agricultural Engineering*. 2018;55(2):1-12.
- Logeswaran K, Kambreakar DN, Mallapur CP, Biradar MS. Management of sucking pests of capsicum by using botanicals under protected condition. *Journal of Farm Sciences*. 2023;36(1):91-97.
- Parisi M, Alioto D, Tripodi P. Overview of biotic stresses in pepper (*Capsicum* spp.): sources of genetic resistance, molecular breeding and genomics. *International Journal of Molecular Sciences*. 2020;21(7):2587.
- Rai AB, Satpathy S, Gracy RG, Swamy TMS. Some approaches in management of sucking pests on chilli with special reference to tarsonemid mite, *Polyphagotarsonemus latus* Banks. *Vegetable Science*. 2009;36(3 Suppl):297-303.
- Senanayake DMJB, Varma A, Mandal B. Virus-vector relationships, host range, detection and sequence comparison of Chilli leaf curl virus associated with an epidemic of leaf curl disease of chilli in Jodhpur, India. *Journal of Phytopathology*. 2012;160(3):146-155.
- Sharma A, Singh R, Kumar S. Host plant resistance in chilli against thrips and mites. *Indian Journal of Entomology*. 2019;81(2):289-295.
- Singh AP, Singh RN. Management of yellow mite, *Polyphagotarsonemus latus* (Acari: Tarsonemidae) in chilli. *Indian Journal of Agricultural Sciences*. 2013;83(11):1250-1252.
- Singh RP, Sahu R, Bagora R, Moharana RL, Tiwari NJ, Sahu P, *et al.* Protected cultivation of horticultural crops: a comprehensive review. *International Journal of Environment and Climate Change*. 2024;14:16-25.
- Yadav S, Kumar L, Jakhar A, Kumar H, Jat MK, Kapoor P, *et al.* Population dynamics of major sucking insect pests on chilli (*Capsicum annuum* L.). *Journal of Agriculture and Ecology*. 2022;13:79-91.