



Whitefly (*Bemisia tabaci* L.) monitoring using yellow sticky traps in relation to screening of cowpea genotypes against yellow mosaic virus

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DOI: <https://doi.org/10.66856/ijer.2026.11.4.11365>

Abstract

The current study monitored adult whiteflies (*Bemisia tabaci* L.) with double-sided yellow sticky traps under natural field conditions while evaluating cowpea genotypes for yellow mosaic virus resistance in 2023-24. The highest whitefly count, 691 i.e. adults per trap, was observed during the 16th Standard Meteorological Week (the third week of April). During this period, temperatures ranged from 19.0°C to 35.9°C, with morning and evening relative humidity at 68% and 22%, respectively, and 7.7 hours of sunshine. The Pearson's correlation analysis showed no correlation between whitefly population and weather factors. Screening of 18 cowpea genotypes (including checks) against yellow mosaic virus incidence showed that 8 genotypes were highly resistant with 5% disease severity (Grade 1), while another 8 genotypes were resistant with 17% severity (Grade 3). Overall, yellow sticky traps can serve as an important component of integrated strategies to manage whitefly-mediated CYMV transmission in the field.

Keywords: CPMV, whitefly, correlation, genotypes, yellow sticky trap

Introduction

Cowpea, *Vigna unguiculata* (L.) Walp., is a vital legume widely cultivated in arid and semi-arid regions, notably in Indian states such as Punjab, Haryana, Rajasthan, Delhi and Uttar Pradesh. It is a multipurpose legume valued for its edible grains, green pods and fodder, and it significantly contributes to the nutrition and livelihoods of resource-constrained farming communities. Cowpea grains are highly rich in protein content and possess significant nutritional value owing to their good taste and minimal levels of antinutritional substances (Singh *et al.*, 2002; Langyintuo *et al.*, 2003) [10, 14]. In addition to its economic significance, its productivity is hindered by various biotic stresses, particularly sucking insect pests that spread viral diseases. Cowpea Yellow Mosaic Virus infections can significantly reduce plant growth and development with a loss reported from 10% to 100% (Kareem and Taiwo, 2007) [7]. Among the sucking pests, whitefly, *Bemisia tabaci* (Genn.) is the prominent vector for causing leaf curl and mosaic in pulses such as moong bean, cowpea, black gram etc.

Monitoring of the vector (whitefly) population at the beginning is important (Gillespie and Quiring 1987) [4] and to monitor insects, various sampling methods like yellow sticky traps (YST) are being employed (Ladd *et al.* 1984, Chandler 1985, Byrne *et al.* 1986) [2, 3, 9]. Furthermore, researchers have also attempted to use YSTs to control whitefly in combination with biocontrol agents under greenhouse conditions (Shen and Ren 2003, Gu *et al.* 2008) [5, 13]. It transmits begomoviruses, particularly mungbean yellow mosaic virus (MYMV) of cowpea and cause characteristic yellow chlorotic patches on leaves (John, 2008) [6], which in turn reduced photosynthetic activity leads to poor/stunted plant growth. Moreover, weather factors like temperature, relative humidity, rainfall and sunshine hours plays an important role in whitefly population build up in

the fields. Yellow sticky traps allow regular estimation of vector abundance without disturbing the crop and can be more useful in vector-mediated disease-screening experiments in natural field conditions. Therefore, the present investigation aimed to characterize the reaction of cowpea genotypes based on maximum disease grade and examine the association of trapped whitefly abundance with prevailing weather parameters. Screening of cowpea genotypes exhibiting resistant or highly resistant reactions may be useful for disease-free crop improvement programmes.



Plate 1: Installation of Yellow sticky traps in cowpea fields (2023-24)

Material and Method

Experimental details

Sixteen Cowpea genotypes under IVT and AVT-1 trials were sown at Dryland Research Farm, CCSHAU, Hisar during Summer season, 2023-24. The crop was maintained under field conditions following the recommended agronomic practices for cowpea, except for any pesticidal spray, to avoid natural expression of pest incidence. All tested entries were alternated with two checks, viz., RC 101 as the susceptible check and CPD 119 as the resistant check. The trial was laid out in a Randomized Block Design (RBD) with three replications. Each tested entry plot size was 3.6 m², with spacing of 45 x 10 cm (Row to row and plant to

plant). The whitefly population was monitored using ten double-sided yellow sticky traps (Size = 20 x 15.7 cm). Ten traps were installed at the initiation of the crop growth stage and later replaced at every 7 day intervals. Weekly observations of trapped whitefly adults were recorded by drawing 1x1cm² square.

Then, the average population of whiteflies per trap were subjected to correlation with weather factors like temperature (maximum & minimum), Relative humidity (Morning & Evening), Sunshine hours and rainfall etc. Further, the screening of cowpea germplasm against CYMV was based on a disease rating scale of 0-9 (Table 1) and disease severity (%).

Table 1: Disease Rating Scales for Cowpea Yellow Mosaic Virus

Grade	Description	Reaction
0	No visible symptoms on leaves or very minute yellow specks on leaves	Free
1	Small yellow specks with restricted spread covering 0.1-5% leaf area	Highly Resistant (HR)
2-3	Mottling of leaves covering 6-10% leaf area	Resistant (R)
4	Yellow mottling covering 11-15% leaf area	Moderately resistant (MR)
5	Yellow mottling and discolouration of 15-20% leaf area	Moderately susceptible (MS)
6	Yellow colouration of 21-30% leaves and yellow pods	Susceptible (S)
7	Pronounced yellow mottling and discolouration of leaves and pods, reduction in leaf size and stunting of plants covering 30-50% of foliage	Susceptible (S)
8	Severe yellow discolouration of leaves covering 50-75% of foliage, stunting of plants and reduction in pod size	Highly susceptible (HS)
9	Severe yellowing of leaves covering above of foliage, stunting of plants and no pod formation	Highly susceptible (HS)

Result and Discussion

As evident from Fig.1 the results revealed that whitefly population starts to build up during 13th Standard meteorological week i.e. 18 whiteflies per trap. The peak activity of whitefly i.e. 691 per trap was observed during 16th SMW i.e. 3rd week of April, 2023^[17] when temperature ranged from 19°C (Tmin) to 35.9°C (Tmax), relative humidity ranged from 22 (Evening) to 68 per cent (Morning) and sunshine was 7.7 hours. Later, the whitefly population started declining at the end of the cropping season. Similarly, Khokhar *et al.* (2019)^[8] observed a seasonal trend in Haryana, where *Bemisia tabaci* reached its peak at the 16th SMW i.e. third week of April in tomato crop. Likewise, Bhowmik *et al.* (2018)^[1] captured the maximum population of whiteflies through YST at 14m height from ground during 16th SW and 17th SW.

Additionally, Chandler (1985)^[3] noted that the height of the yellow sticky trap is crucial for effective mass trapping and monitoring of whitefly populations. Similarly, Toscano *et al.* (2002)^[15] found that trap placement and height influence the number of whiteflies captured.

Pearson's correlation analysis revealed that the weather factors (temperature, relative humidity, sunshine hours, rainfall, wind speed and rainy days) had a non-significant impact on whitefly population (fig.2). Similar results were obtained by Mehra (2020)^[12], where no significant correlation was observed between whitefly trap catches and weather factors. Likewise, Khokhar *et al.* (2019)^[8] reported a significant negative correlation with evening relative humidity, while maximum and minimum temperature, sunshine hours, rainfall, morning RH and wind velocity were non-significant.

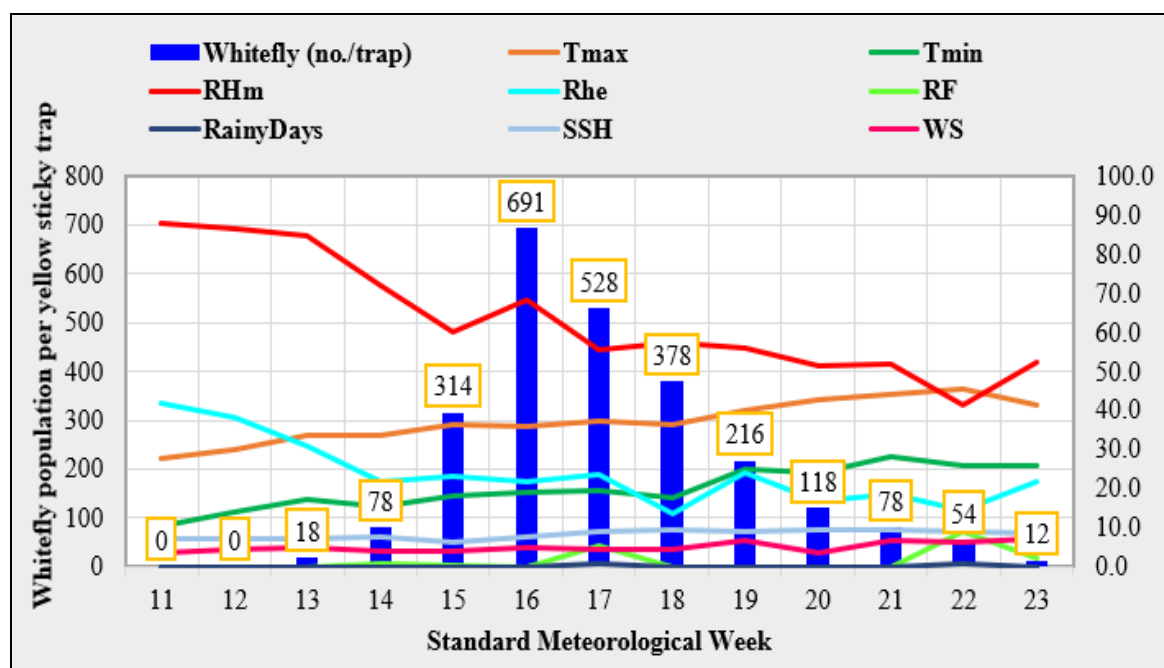


Fig 1: Monitoring of adult whiteflies using yellow sticky traps in Cowpea crop during 2023-24

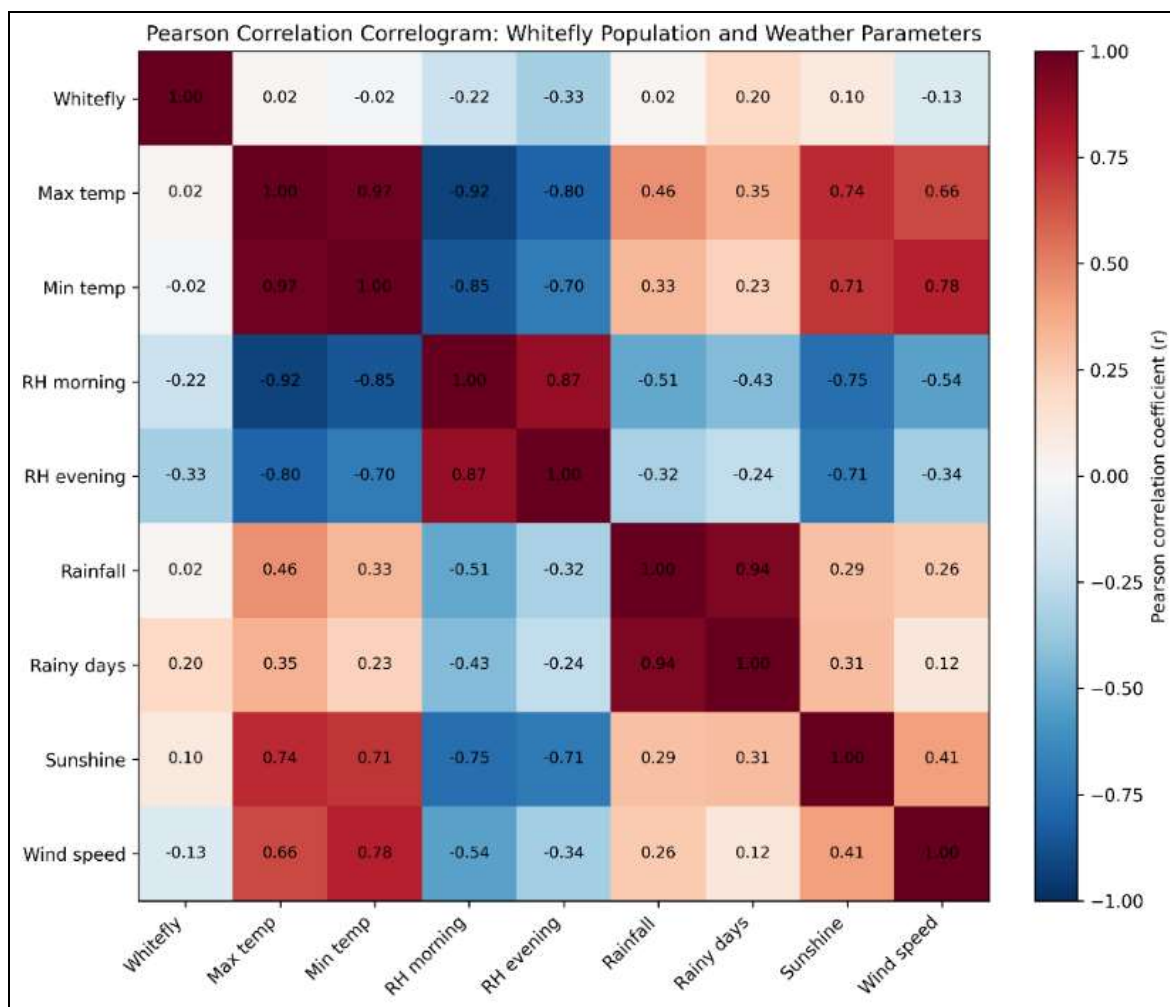


Fig 2: The Pearson correlation correlogram of whitefly population and weather parameters (2023-24)

It is evident from Table 2 that of 18 cowpea genotypes, including checks, 8 (GC 2115, KVCP 17-15, CPD 307, PL 4, PCP 0306-1, GC 1905^[18] (AVT-1), DC 15 and PL-3) were highly resistant (Grade 1; 5% disease severity) and 8 were resistant (Grade 3; 17% disease severity). Two entries, CPD 269 and RC-19, were found moderately susceptible (Grade 5; 25% disease severity).

These findings align closely with Yadav *et al.* (2026)^[16], who identified the GC-3 genotype as the least susceptible to whitefly and RC-19 as highly susceptible. Similarly, Ranawat *et al.* (2020)^[12] reported that the cowpea variety RC-19 was highly susceptible, while RC-101 was moderately susceptible to whitefly infestation, supporting the current investigation.

Table 2: Evaluation of the genotypes of arid legumes (cowpea) against cowpea yellow mosaic virus during *kharif* 2023

Sr. No.	Cowpea genotype/entry	Observations		Grading scale	Disease Severity (%)
		I	II		
1	GC- 3	1	3	3 (Resistant)	17
2	CPD 269	1	5	5 (Moderately susceptible)	25
3	GC 2115	1	1	1 (Highly Resistant)	5
4	KVCP 17-15	1	1	1 (Highly Resistant)	5
5	PGCP 84	1	3	3 (Resistant)	17
6	GC 2108	3	3	3 (Resistant)	17
7	CPD 307	1	1	1 (Highly Resistant)	5
8	TC 901	3	3	3 (Resistant)	17
9	PGCP 85	3	3	3 (Resistant)	17
10	PL-4	1	1	1 (Highly Resistant)	5
11	CPD 302	1	3	3 (Resistant)	17
12	PCP 0306-1	1	1	1 (Highly Resistant)	5
13	KBC 9	1	3	3 (Resistant)	17
14	GC 2006 ^[17] (AVT-1)	1	3	3 (Resistant)	17
15	GC 1905 ^[18] (AVT-1)	1	1	1 (Highly Resistant)	5
16	DC 15	0	1	1 (Highly Resistant)	5
17	RC-19 (Susceptible check)	3	5	5 (Moderately susceptible)	25
18	PL-3 (Resistant check)	1	1	1 (Highly Resistant)	5

Conclusion

The field results support the idea that controlling whitefly vectors is essential for reducing cowpea yellow mosaic virus (CYMV) incidence. Using yellow sticky traps to monitor and catch whiteflies led to low vector activity, which correlated with minimal CYMV infection and severity in the tested cowpea genotypes. The lower levels of disease imply that trapping could be effective in reducing virus spread and disease development by controlling whitefly populations. Therefore, yellow sticky traps can be a valuable part of an integrated approach to controlling whitefly-mediated CYMV spread in the field.

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