



Seasonal dynamics of planthoppers in relation to weather parameters in coastal Agri-horticulture ecosystems of Karaikal, Puducherry, India

Ganesh S, M Kandibane

Department of Agricultural Entomology, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, U.T. of Puducherry, India

Abstract

The present study was investigated on the seasonal dynamics of planthoppers and their association with meteorological parameters in agricultural and horticultural ecosystems at Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA & RI), Karaikal, Puducherry, India, during October 2025 to June 2026. Planthoppers were collected using sweep net, light trap, yellow sticky trap, bagging and aspirator methods, and their abundance was recorded at weekly intervals for two seasons viz., *Rabi* 2025 and Summer 2026. A total of 11 and 12 planthopper species belonging to six and five subfamilies were recorded during *Rabi* 2025 and Summer 2026, respectively. The abundance of planthoppers was considerably high during *Rabi* 2025, with 662 individuals belonging to six subfamilies, compared with 119 individuals representing five subfamilies during Summer 2026. Delphacinae was the predominant subfamily in both seasons, accounting for 588 individuals during *Rabi* and 104 individuals during Summer. Peak abundance of Delphacinae was recorded during the 49th, 1st and 2nd Meteorological Standard Weeks in *Rabi* 2025, whereas the highest population was observed during the 12th, 11th and 16th weeks during Summer 2026. Correlation analysis revealed significant positive associations between minimum temperature and Cixiinae ($r = 0.48$) and between evening relative humidity and Delphacinae ($r = 0.50$) during *Rabi* 2025. During Summer 2026, rainfall exhibited a significant positive correlation with Dictyopharinae ($r = 0.54$). No significant negative correlations were observed between the meteorological parameters and planthopper subfamilies in either season.

Keywords: Planthoppers, seasonal dynamics, meteorological parameters, Delphacinae, Cixiinae, Dictyopharinae

Introduction

Hoppers constitute a diverse group of insects belonging to the order Hemiptera. Several groups, including leafhoppers, planthoppers, treehoppers, and froghoppers are known to infest a wide range of crops. All these groups are classified under the suborder Auchenorrhyncha (Nielson, 1968) [9]. Planthoppers are taxonomically classified under the superfamily Fulgoroidea within the infraorder Fulgoromorpha of the suborder Auchenorrhyncha, comprising approximately 20 families. Economically important species are distributed across several families, including Cixiidae, Delphacidae, Derbidae, Dictyopharidae, Eurybrachidae, Flatidae, Fulgoridae, Hypochthonellidae, Issidae, Lophopidae, Meenoplidae, Tettigometridae, and Tropiduchidae. Among these, Delphacidae is the largest family in Fulgoroidea, with about 2,000 described species across nearly 280 genera (O'Brien and Wilson, 1985) [12].

Adults and nymphs of these pests cause 'hopper-burn' by sucking sap from tillers, leading to chlorosis, wilting, and yield losses of 10 to 70 per cent (Dey *et al.*, 2024) [4]. Hopper burn has led to significant yield and economic losses globally (Horgan *et al.*, 2018; Quayum, *et al.*, 2023) [5, 13]. In addition to physical damage, planthoppers are known vectors of several serious viral diseases affecting major crops. For instance, sugarcane yellow leaf syndrome is transmitted by *Saccharosydne saccharivora* (Westwood), while Fiji disease virus is spread by *Perkinsiella saccharicida* (Kirkaldy), *Perkinsiella sinensis* (Distant), and *Perkinsiella vastatrix* (Kirkaldy) (Wilson, 2005) [16].

This present investigation assessed the influence of meteorological parameters, including maximum and

minimum temperature, rainfall, and relative humidity, on planthopper populations. The study aimed to determine their period of peak activity, which could facilitate the timely adoption of appropriate management measures under field conditions and thereby minimize crop losses.

Materials and Methods

The present investigation on the seasonal dynamics of planthoppers in an agricultural and horticultural ecosystem was carried out during October 2025 to June 2026 at Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA and RI), Karaikal, U. T. of Puducherry, India. The study area is situated at 10°52' North latitude and 79°52' East longitude, with an elevation of 4 meters above mean sea level. Planthoppers were collected from different crop plants and trees present in agricultural and horticultural ecosystems by adopting various collection methods such as sweep net, light trap, yellow sticky trap, bagging, and aspirator

Meteorological factors and their association

Meteorological parameters, including maximum and minimum temperature, morning and evening relative humidity (RH), rainfall (RF), and sunshine hours, were recorded on a daily basis during both seasons at the Meteorological observatory of the Department of Agronomy, PAJANCOA & RI, Karaikal, U.T. of Puducherry. To assess the influence of these meteorological variables on planthoppers population dynamics, correlation analysis was performed between the recorded weather parameters and the population abundance of planthoppers associated with horticultural crops.

Results and Discussion

During the period of investigation, the planthopper fauna comprised 11 and 12 species belonging to 6 and 5 subfamilies during the *Rabi* 2025 and Summer 2026 seasons, respectively. The seasonal incidence of planthopper families during *Rabi* 2025 and Summer 2025 (Weekly average) were presented in Table 1 and 2 (Fig.1,2). The simple correlation of planthoppers with meteorological parameters viz., maximum and minimum temperature, morning and evening relative humidity, rainfall, and sunshine hours, during *Rabi* 2025 and Summer 2026 are presented in Table 3 and 4.

Seasonal dynamics of planthopper subfamilies

The seasonal dynamics of planthopper subfamilies varied considerably between the *Rabi* 2025 and Summer 2026 seasons. During *Rabi* 2025, a total of 662 individuals representing six subfamilies, viz., Cixiinae, Delphacinae, Derbinae, Eurybrachinae, Flatinae and Kermesiinae, were recorded. In contrast, the Summer 2026 season accounted for 119 individuals belonging to five subfamilies, viz., Cixiinae, Delphacinae, Derbinae, Dictyopharinae and Kermesiinae. Delphacinae was the dominant subfamily in both seasons, accounting for 588 individuals during *Rabi* 2025 and 104 individuals during Summer 2026. During *Rabi* 2025, Delphacinae abundance ranged from 0 to 125 individuals, with peaks recorded during the 49th (125), 1st (95), and 2nd MSW (78). Kermesiinae attained its maximum abundance during the 52nd MSW (20). However, Cixiinae, Derbinae, Eurybrachinae and Flatinae recorded relatively low abundances, with maximum population counts of 4, 2, 2 and 1 individuals, respectively. During Summer, Delphacinae ranged from 0 to 19 individuals and attained its peak abundance during the 12th (19), 11th (11), and 16th MSWs (10). Kermesiinae recorded a maximum of two individuals during the 10th and 13th MSWs, while Cixiinae was recorded during the 11th, 12th, 13th, and 26th MSWs.

Dictyopharinae occurred during the 11th, 19th, and 25th MSWs, with one individual in each week, whereas Derbinae attained a maximum population of two individuals during the 9th MSW. These results are in agreement with the findings of Nirala *et al.* (2015) [10] and Nishanthini and Kandibane (2021) [11]. Similarly, Narayana *et al.* (2022) [8] observed an increase in hopper abundance during the *Rabi* season, followed by a decline towards the later stages of the season. Liu (1988) [7] suggested that wet-season conditions may favour the completion of additional generations, thereby supporting relatively greater planthopper abundance even under cooler and more humid conditions than those prevailing during the dry season.

Influence of density-independent factors on the abundance of planthopper subfamilies

During the *Rabi* 2025 season, significant positive correlations were observed between minimum temperature and Cixiinae ($r = 0.48$) and between evening relative humidity and Delphacinae ($r = 0.50$). During Summer 2026, rainfall showed a significant positive correlation with Dictyopharinae ($r = 0.54$). No significant negative correlations were observed between the meteorological parameters and planthopper subfamilies during both the season. Sharma *et al.* (2024) and Anand *et al.* (2023) [1, 14] reported a significant positive correlation between planthoppers and morning relative humidity, while Verma *et al.* (2021) [15] and Chaudhary *et al.* (2014) [3] observed significant positive correlations with morning and evening relative humidity. Aziz and Akter (2026) reported that mean temperature exhibited a significant positive correlation with planthoppers. Krishnaiah *et al.* (2005) [6] stated that planthoppers could not tolerate a constant temperature exceeding 35°C. Conversely, Nirala *et al.* (2015) [10] reported that none of the weather parameters showed a significant correlation with planthopper populations.

Table 1: Seasonal abundance of planthopper subfamilies in agri-horticultural ecosystems during the *Rabi* 2025 season (November to March 2026) [17].

Sl. No.	Meteorological standard week (MSW)	Cixiinae	Delphacinae	Derbinae	Eurbrachinae	Flatinae	Kermesiinae
1.	44 (Oct–Nov 2025)	0	0	1	0	0	4
2.	45 (Nov 2025)	3	12	0	0	0	11
3.	46 (Nov 2025)	4	2	0	0	0	6
4.	47 (Nov 2025)	0	21	0	0	0	0
5.	48 (Nov–Dec 2025)	0	47	0	0	0	0
6.	49 (Dec 2025)	0	125	0	0	0	1
7.	50 (Dec 2025)	0	11	0	0	1	0
8.	51 (Dec 2025)	1	9	0	2	1	0
9.	52 (Dec 2025)	0	65	0	0	0	20
10.	1 (Jan 2026)	0	95	0	2	0	0
11.	2 (Jan 2026)	0	78	1	0	0	0
12.	3 (Jan 2026)	0	68	0	0	0	6
13.	4 (Jan 2026)	0	9	0	0	0	0
14.	5 (Jan–Feb 2026)	0	12	0	0	0	1
15.	6 (Feb 2026)	0	11	0	0	0	2
16.	7 (Feb 2026)	0	14	0	0	0	5
17.	8 (Feb 2026)	0	4	0	0	0	0
18.	9 (Feb 2026)	0	5	2	0	0	0
Total		8	588	4	4	2	56

Table 2: Seasonal abundance of planthopper subfamilies in agri-horticultural ecosystems during the Summer 2026 ^[22] season (March to June 2026) ^[18].

Sl. No.	Meteorological standard week (MSW)	Cixiinae	Delphacinae	Derbinae	Dictyopharinae	Kermesiinae
1.	9 (Feb–Mar 2026)	0	5	2	0	0
2.	10 (Mar 2026)	0	9	0	0	2
3.	11 (Mar 2026)	1	11	0	1	0
4.	12 (Mar 2026)	1	19	0	0	1
5.	13 (Mar–Apr 2026)	1	4	0	0	2
6.	14 (Apr 2026)	0	9	0	0	1
7.	15 (Apr 2026)	0	7	0	0	0
8.	16 (Apr 2026)	0	10	0	0	0
9.	17 (Apr 2026)	0	3	0	0	0
10.	18 (Apr–May 2026)	0	9	0	0	0
11.	19 (May 2026)	0	8	0	1	0
12.	20 (May 2026)	0	2	0	0	0
13.	21 (May 2026)	0	1	0	0	0
14.	22 (May–Jun 2026)	0	0	0	0	0
15.	23 (Jun 2026)	0	5	0	0	0
16.	24 (Jun 2026)	0	0	0	0	0
17.	25 (Jun 2026)	0	2	0	1	0
18.	26 (Jun–Jul 2026)	1	0	0	0	0
Total		4	104	2	3	6

Table 3: Correlation of occurrence of planthopper subfamilies with meteorological parameters during the *Rabi* 2025 season (November 2025 to February 2026) ^[19].

Subfamilies	Maximum	Minimum	Morning	Evening	Rainfall (mm)	Sunshine hours
Cixiinae	0.38	0.48*	0.00	-0.05	0.00	-0.22
Delphacinae	-0.41	-0.09	0.43	0.50*	0.21	-0.26
Derbinae	0.38	0.05	-0.53*	-0.45	-0.12	0.19
Eurybrachinae	-0.16	-0.13	-0.11	0.10	-0.19	0.00
Flatinae	-0.17	-0.30	-0.36	0.06	-0.17	-0.04
Kermesiinae	0.27	0.07	-0.06	-0.34	-0.28	0.35

Table 4: Correlation of occurrence of leaf- and planthopper subfamilies with meteorological parameters during the Summer 2026 ^[22] season (March to June 2026) ^[18].

Subfamilies	Maximum	Minimum	Morning	Evening	Rainfall (mm)	Sunshine hours
Cixiinae	-0.42	-0.35	0.40	0.12	-0.02	0.19
Delphacinae	-0.52	-0.47	0.46	0.43	0.33	-0.13
Derbinae	-0.39	-0.44	-0.09	0.05	-0.16	0.02
Dictyopharinae	-0.26	0.01	0.38	0.32	0.54*	-0.41
Kermesiinae	-0.12	-0.18	-0.17	-0.14	0.31	-0.19

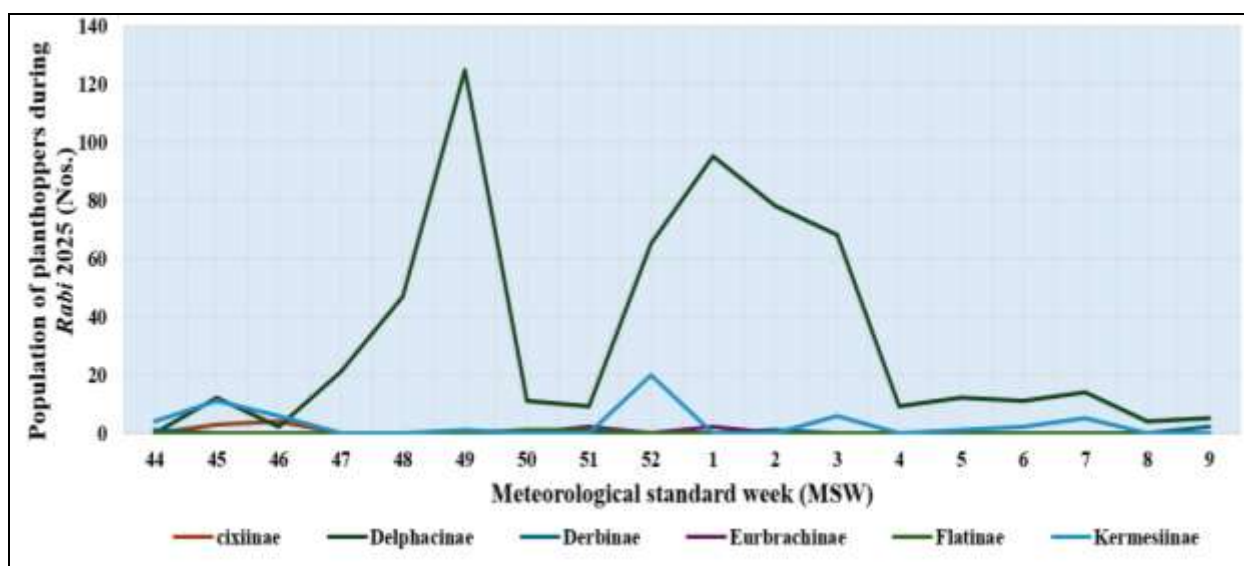


Fig 1: Seasonal abundance of planthoppers in agri-horticultural ecosystems during the *Rabi* 2025 season.

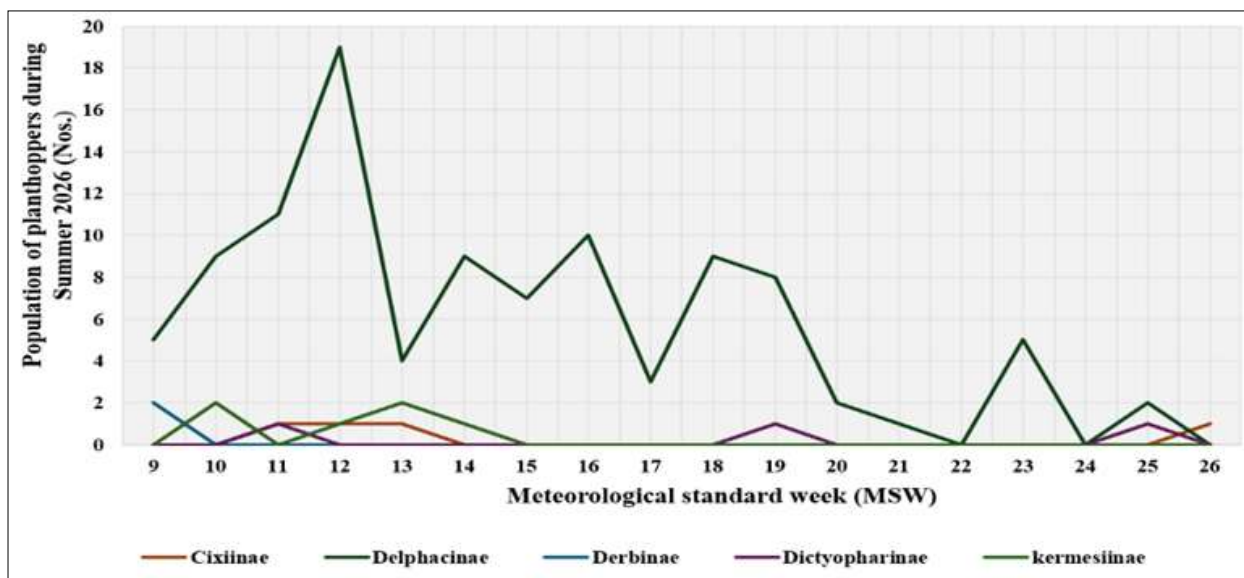


Fig 2: Seasonal abundance of planthoppers in agri-horticultural ecosystems during the Summer 2026 ^[22] season.

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