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Influence of weather Parameters on the Seasonal Incidence of Mango Hopper, *Idioscopus nitidulus* Walker in Middle Gujarat

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ABSTRACT: To understand the impact of various climatic factors on the occurrence and abundance of hoppers infesting mango, a study was carried out at Horticulture Farm, B. A. College of Agriculture, Anand Agricultural University, Anand during the year 2021-22. The incidence of mango hopper started gradually increased from 40th to 45th SMW corresponding to the 1st week of October to 1st week of November. During 46th SMW, hopper population slightly decreased but again, the incidence started increasing from 0.64 hopper/panicle in the 3rd week of November (47th SMW) to 5.41 hoppers/panicle in 1st week of January (1st SMW), after which it decreased to 5.04 and increased 5.88 hoppers/panicle in 2nd and 4th week of January, respectively. Following that, the population continued to grow and eventually reached its peak (12.41 hoppers/panicle) during 4th week of March (13th SMW). Correlation analysis with various weather parameters indicated that there was highly significant correlation between evapotranspiration and hopper population, while bright sunshine hours had significant positive correlation with the population of mango hopper. The evening relative humidity had highly significant but, negative correlation with population of mango hoppers. Many workers have reported the population dynamics of mango hopper in different regions of Gujarat but information pertaining to specific species *Idioscopus nitidulus* is lacking. Hence, the study on various climatic factors on the occurrence and abundance of hoppers infesting mango was conducted.

Keywords: Mango hopper, population, *Idioscopus nitidulus*, SMW.

INTRODUCTION

Mango (*Mangifera indica* Linnaeus) is India's national fruit and is renowned as the "King of Fruits" because of its adaptability, excellent taste, unique flavour, exemplary nutritious content, versatility, attractive colour, look, and widespread popularity. Mangoes help to lower the cholesterol and the fiber content is a wonderful aid to digestion regularity and they are rich in the vitamins A and C. Ripe mangoes may have a variety of colors, being red, orange, green to yellow when ripe (Tharanathan and Yashoda 2006). It is regarded a prominent fruit in India, and there are over 1,365 species of mangoes grown worldwide, with India alone cultivating over 1,000 types. Pests create havoc on this fruit tree on a regular basis, constituting a severe danger to the mango orchard. At the global level, the crop is attacked by 492 insect species, 17 mite species, and 26 nematode species. Out of all the insect-pests attacking mango, mango hoppers (*A. atkinsoni* and *Idioscopus* spp.), stem borer (*B. rufomaculata*), mango stone weevil (*S. mangiferae*), fruit fly (*B. dorsalis*) and leaf gall fly (*P. matteiana* Keiffer and Cocconi) causes considerable damage to mango trees. The mango hopper has been found in most tropical and sub-tropical countries in South East Asia, in addition to causing serious damage in India's numerous states. Mangoes are attacked by hoppers throughout the year, but the damage is more severe during the reproductive and early fruiting stages, with losses ranging from 32 to 68 per cent. Damage is caused by both nymphs and adults by sucking the sap from tender leaves, inflorescence as a consequence of which inflorescences and fruits if any set, fall prematurely. Mango hoppers also secrete honey dew which facilitates the development of sooty mold on twigs, leaves and inflorescences. Due to sooty mold, photosynthetic activity adversely affected and ultimately fruit setting is also affected (Raut *et al*., 2018). It is essential to have a basic understanding of the population dynamics and seasonal occurrence of pests in relation with the most prevalent weather parameters in order to design an early warning weather-based system for any pest in a given agro-ecosystem. This will make it more simple to decide when to act and how to apply the best pest management techniques.

MATERIALS AND METHODS

The investigations on seasonal incidence of mango hopper, *Idioscopus nitidulus* Walker in relation to weather parameters were carried out at the Horticulture farm, B. A. College of Agriculture, Anand Agricultural University, Anand (Gujarat) during the year 2021-22. All the recommended horticultural practices were followed and the plot was kept free from chemical spray. To study the seasonal incidence of hoppers, the experiments was carried out during October, 2021 to March, 2022. For this purpose, five trees of mango (*cv.* Amrapali) were selected randomly. From each tree, one branch from each direction (North, East, West and South) was considered for recording the observations. Again, within each branch, five panicles were selected randomly for counting the hoppers.

Statistical Analysis. The data on weather parameters *viz*., maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours, wind speed and evapotranspiration were collected from Meteorological Observatory, B. A. College of Agriculture, Anand Agricultural University, Anand. The correlation between average mango hopper population and various weather parameters was worked out by the Pearson's correlation coefficient**.**

RESULTS AND DISCUSSION

The data on number of leaf hoppers per panicle under field conditions along with weather parameters *viz*., temperature (maximum and minimum), relative humidity (morning and evening), rainfall, evapotranspiration, vapour pressure (morning and evening), wind speed and bright sunshine hours are presented in Table 1 and correlation between mango hopper, *I. nitidulus* incidence along with weather parameters are presented in Table 2 and Fig. 1.

The activity of *I. nitidulus* was found throughout the experimental period from first week of October, 2021 [40th Standard Meteorological Week (SMW)] to last week of March, 2022. The observations on incidence of mango hopper revealed that infestation started from 1st week of October onwards (0.29 hopper/panicle) when the temperature, relative humidity and rainfall were 29.75°, 77.5 per cent and 18 mm, respectively. The incidence of mango hopper started gradually increasing from 40th to 45th SMW corresponding to the 1st week of October to 1st week of November. The incidence was 0.73 hopper/panicle in 45th SMW, when temperature and relative humidity was 24.9° and 47.5 per cent, respectively. However, it slightly decreased from 0.73 to 0.58 hopper/panicle during 46th SMW.

Again, the incidence started increasing with 0.64 hopper/panicle in the 3rd week of November (47th SMW) to 5.41 hoppers/panicle in 1st week of January (1st SMW), after which it decreased to 5.04 during the 2nd week of January and again it increased (5.88 hoppers/panicle) in 4th week of January. The number of hoppers per twig ranged from 2.10 to 5.73 between 1st and 5th SMW. Following that, the population continued to grow and eventually reached its peak (12.41 hoppers/panicle) during 4th week of March (13th SMW). The present findings are in agreement with Jha *et al*. (2017), who reported a higher hopper population during 13th to 15th SMW. Throughout the period of observation, the average hopper population per panicle was varied from 0.29 to 12.41 *i.e.*, from 1st October, 2021 to 26th March, 2022. Earlier experimental findings of Kumar *et al*. (2009); Rahman *et al*. (2007); Sahu and Jha (2008) showed that the incidence of mango leafhoppers was found throughout the year. The number of hoppers per twig ranged from 0.27 to 0.73 between 42nd and 45th SMW (Patel *et al*., 2020). The number of hoppers/ inflorescence increased from 0.73 to 5.19 in November-December, due to the beginning of fresh vegetative growth (Bhut *et al*., 2017). These reports are in close agreement with the findings of present investigation.

The correlation coefficient data (Table 2 and Fig. 1) indicated that evapotranspiration (r=0.639**) had highly significant and positive correlation and bright sunshine hours (r=0.431*) had significant positive correlation with population of mango hopper, *I. nitidulus* whereas, evening relative humidity (r=-0.528**) had highly negative but significant correlation with population of mango hoppers. Whereas, wind speed (r = -0.194), rainfall (r = -0.322), minimum temperature (r = -0.250), morning relative humidity (r = -0.247), morning vapour pressure (r= -0.351) and evening vapour pressure (r = -0.382) had negative, while maximum temperature (r = 0.239) showed positive but non-significant association with hoppers. Patel *et al*. (2020) reported that maximum temperature (r = 0.093) showed positive correlation, whereas minimum temperature (r = -0.217) exhibited negative correlation with population of hoppers. Sarode and Mohite (2016) documented that temperature (r = 0.302) had positive while, rainfall (r = -0.062) and relative humidity (r = -0.383) had negative correlation with the incidence of mango hoppers. Relative humidity has negative effect on hopper population in present study which is in conformity with the findings of Anithakumari *et al*. (2010).

Table 1: Seasonal incidence of hopper, *I. nitidulus* infesting mango in relation to weather parameters.

Months	Week	SMW	No. of hoppers /panicle	Temperature (°)			Relative humidity (%)			Wind speed (Km/hr)	Rainfall (mm)	EP (mm)	BSS (hrs/day)	Vapour Pressure (mm of Hg)	
				Max.	Min.	Mean	RH_1	RH_2	Mean					VP_1	VP_2
Oct. 2021	I	40	0.29	33.6	25.9	29.75	92	63	77.5	2.8	18.0	3.3	6.6	23.8	23.9
	II	41	0.37	35.0	25.8	30.4	91	58	74.5	2.5	0.4	3.1	6.6	23.5	23.0
	III	42	0.45	34.7	21.6	28.15	83	38	60.5	3.0	0.0	4.2	8.3	17.7	14.9
	IV	43	0.57	33.1	21.2	27.15	83	41	62.0	2.5	0.0	3.3	9.3	17.2	14.4
	V	44	0.65	33.1	16.7	24.90	73	23	48.0	2.9	0.0	3.7	9.7	11.8	9.3
Nov. 2021	I	45	0.73	32.8	17.0	24.90	67	28	47.5	3.3	0.0	3.5	8.2	10.7	9.9
	II	46	0.58	31.2	18.0	24.60	62	36	49.0	5.0	0.0	4.3	7.2	10.1	11.2
	III	47	0.64	31.7	20.7	26.20	84	50	67.0	4.4	0.0	3.3	6.0	15.7	17.1
	IV	48	1.17	30.6	16.4	23.50	83	53	68.0	3.2	11.2	2.9	7.0	12.3	13.2
Dec. 2021	I	49	2.10	26.1	17.6	21.85	86	62	74.0	4.5	2.2	1.8	4.4	13.1	16.5
	II	50	2.74	28.1	16.5	22.30	80	49	64.5	3.5	0.0	2.6	6.5	11.6	13.3
	III	51	4.04	28.6	11.2	19.90	78	38	58.0	4.1	0.0	3.2	8.3	8.0	9.7
	IV	52	5.19	23.3	12.5	17.90	81	48	64.5	2.1	0.6	1.7	5.6	10.2	11.5
Jan. 2022	I	1	5.41	27.6	16.7	22.15	91	58	74.5	3.3	0.0	2.3	5.0	13.5	15.3
	II	2	5.04	23.9	11.1	17.50	87	39	63.0	4.2	0.0	3.1	8.7	8.9	8.1
	III	3	6.26	26.7	12.9	19.80	90	49	69.5	3.4	0.0	2.5	8.7	10.7	12.4
	IV	4	5.88	24.5	10.4	17.45	84	42	63.0	3.9	0.0	3.2	7.6	8.6	9.3
	V	5	6.72	28.8	10.9	19.85	88	37	62.5	2.2	0.0	2.9	8.8	9.4	10.4
Feb. 2022	I	6	8.08	29.0	12.4	20.70	86	33	59.5	2.8	0.0	3.4	9.0	9.7	9.3
	II	7	9.18	30.1	13.5	21.80	77	32	54.5	2.7	0.0	3.8	9.7	9.4	10.2
	III	8	9.75	32.2	14.2	23.20	83	37	60.0	2.4	0.0	4.6	9.8	10.7	12.9
	IV	9	10.23	33.6	16.8	25.20	75	29	52.0	3.1	0.0	5.2	9.6	11.2	10.6
Mar. 2022	I	10	11.36	34.5	18.2	26.35	70	30	50.0	2.9	0.0	5.2	8.7	12.0	11.8
	II	11	11.16	38.2	19.0	28.6	70	26	48.0	3.1	0.0	6.8	9.7	12.9	12.4
	III	12	12.06	37.7	22.2	29.95	60	27	43.5	4.2	0.0	7.4	7.1	12.9	11.7
	IV	13	12.41	38.6	20.5	29.55	83	28	55.5	2.8	0.0	6.6	9.1	16.4	14.1

SMW = Standard meteorological week; EP = Evapotranspiration; BSS = Bright sunshine hours

Table 2: Correlation co-efficient between weather parameters and hopper, *I. nitidulus* infesting mango.

Weather parameters	Correlation coefficient (r)
Bright sunshine hours, hr day-1 (BSS)	0.431*
Rainfall, mm (RF)	-0.322
Wind Speed, km hr-1 (WS)	-0.194
Maximum Temperature, ℃ (Max T)	0.239
Minimum Temperature, ℃ (Min T)	-0.250
Morning Relative Humidity, % (RH1)	-0.247
Evening Relative Humidity, % (RH2)	-0.528**
Morning Vapour pressure, mm of HG (VP1)	-0.351
Evening Vapour pressure, mm of HG (VP2)	-0.382
Evapotranspiration, mm (EP)	0.639**

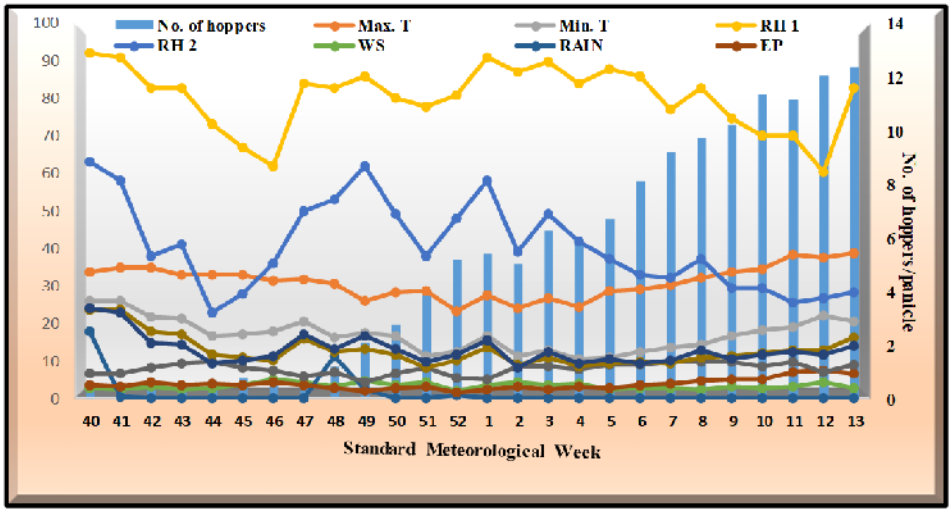

Fig. 1. Population fluctuation of hopper, *Idioscopus nitidulus* infesting mango in relation to weather parameters

CONCLUSION

The population of hoppers was found throughout the experimental period. The maximum population (12.41 hoppers/panicle) observed during 4th week of March (13th SMW). The correlation coefficient data reveled that evapotranspiration had highly significant and positive correlation and bright sunshine hours had significant positive correlation with the population of mango hopper. All this information, may be useful to develop region specific crop simulation dynamics models to predict and forecast the insect pest's population so that mango growers/farmers can adopt the control measures well in advance to save the fruit crop being lost. Future research work must be done to make more accurate predictions in extremely variable temperatures even for a certain place, it is usually preferable to gather data from various geographic regions.

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Conflict of Interest. None.

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