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Population dynamics of mango leaf gall midge, *Protocontarinia matteiana* and its correlation with weather parameters

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ABSTRACT: Highest leaf gall midge damage (60.49 %) was observed on 7th standard week (SW) coinciding with pea cum marble sized fruit stages of the crop. It was positively influenced by sunshine and negatively by temperature (minimum and average), relative humidity, rainfall and wind velocity. The lowest leaf damage (31.69 %) was observed during 36 SW coinciding with emergence of new flush stage.

KEY WORDS: Population dynamics, weather parameters, mango, leaf gall midge, *Protocontarinia matteiana*

INTRODUCTION

Mango (*Mangifera indica* L. : Anacardiaceae), occupies a pride place amongst the fruits grown in the country. It has been found attacked by as many as 492 pest species in India (Butani, 1974). Of these, leaf gall midge, *Protocontarinia matteiana* Kieffer & Cecconi (Cecidomyiidae: Diptera) earlier considered a minor pest, has recently assumed a major pest status in the mango growing tracts of south Gujarat. It is commonly called mango midge fly due to its close association with leaves as well as fruits.

It is observed throughout the year causing galls in new flush leading to defoliation and reduction of the photosynthetic activity. So the present investigation on the population dynamics of mango leaf gall midge and its correlation with weather parameters was carried out at the Regional Horticultural Research Station (RHRS), Navsari Agricultural University (NAU), Navsari.

MATERIALS AND METHODS

A field experiment with 12 randomly selected 15 year old mango (cv. Kesar) trees in an insecticide free 1 ha. plot was conducted at the RHRS, NAU, Navsari, Gujarat during 2009-11. To study the population dynamics, the number of healthy as well as damaged leaves was counted on each of the ten terminal twigs from the lower canopy of each experimental tree at weekly interval throughout the year and was calibrated as per cent leaf damage. Important meteorological data *viz*., temperature (maximum and minimum), relative humidity (morning and evening), rainfall, rainfall days, sun shine and wind velocity were recorded at weekly interval during October 2009-June 2011.

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RESULTS AND DISCUSSION

The damage was assessed in terms of percentage of leaves damaged. Highest leaf damage (60.64, 62.64 and 60.49 % in 2009-10, 2010-11 and in pooled results, respectively) was observed during 6 (5-11 Feb.), 7 (12-18 Feb.) and 7 SW which coincided with peak flowering and pea cum marble sized fruit stages of the crop (Table 1). High to very high (> 50 %) leaf damage was also observed during the periods of 52-9 SW (24 Dec.- 4 March). Comparatively lower leaf damage of < 30 % (32.56, 30.18 and 31.69 per cent during 36 (3-9 Sep.), 35 (27 Aug. - and 2 Sep.) and 36 SW, respectively) observed coincided with emergence of new flush.

Peak leaf damage was observed during 7th SW (12-18 February) (60.49 % in pooled results) which happened to be the pea cum marble sized fruit stage of the crop. However, the damage (31.69 % in pooled results) started at the emergence of new flush (36 SW) (3-9 Sep.). This may be attributed to the thin leaf epidermis of the new flush which facilitated easy oviposition leading to puncturing of leaf epidermis and hyperplasia (initiation of swelling symptoms). As the leaves matured, the swellings became warts and ultimately the galls. The increase in swelling size may be due to the metamorphic changes in the maggots, requiring more inner epidermal space leading to the formation of galls in thick mature leaves at pea/marble sized fruit stage (7 SW) (12-18 Feb.).

As per the population dynamics of leaf gall midge, Patel (2011) reported highest leaf damage (62.51 %) and gall intensity (116.56 galls/sq.cm. on infested leaves) caused by *P. matteiana* in Alphonso during 5-6 (29 January-11 February) and 1-2 (1-14 January) standard weeks and 56.80 per cent with 105.69 galls during 7-8 (12-25 February) and 1-2 (1-14 January) standard weeks in Kesar. In the present findings, highest leaf damage (60.49 % in pooled result) was observed during 7th SW (12-18 Feb.).

Table- 1. Population dynamics of mango leaf gall midge, *Procontarina matteiana*

Std. week	Std. Period	Crop Stage	Leaf gall midge (Leaf Damage %)		
			2009-10	2010-11	Pooled
48	26 Nov- 2 Dec 2009	Bud/bud burst	44.12	42.24	43.18
49	3-9 Dec	Bud/bud burst	46.26	44.27	45.27
50	10-16 Dec	Bud/bud burst	47.35	48.35	47.85
51	17-23 Dec	Bud/bud burst	49.12	48.54	48.83
52	24-31 Dec	Bud/bud burst	50.72	51.38	51.05
1	1-7 Jan 2010	In Flowering	52.12	53.58	52.85
2	8-14 Jan	In Flowering	52.94	52.42	52.68
3	15-21 Jan	In Flowering	54.62	56.12	55.37
4	22-28 Jan	In Flowering	56.72	56.88	56.80
5	29 Jan- 4 Feb	Peak Flowering	58.18	58.64	58.41
6	5-11 Feb	Peak Flowering	60.64	58.98	59.81
7	12-18 Feb	Pea/Marble	58.34	62.64	60.49
8	19-25 Feb	Pea/Marble	52.24	56.68	54.46
9	26 Feb-4 March	Pea/Marble	50.36	51.24	50.80
10	5-11 March	Pea/Marble	45.46	48.68	47.07
11	12-18 March	Stone Size	42.18	46.82	44.50
12	19-25 March	Stone Size	44.26	44.00	44.13
13	26 March-1 Apr	Stone Size	42.22	40.26	41.24

Std. week	Std. Period	Crop Stage	Leaf gall midge (Leaf Damage %)		
			2009-10	2010-11	Pooled
14	2-8 Apr	Stone Size	40.28	38.36	39.32
15	9-15 Apr	Stone Size	38.22	36.74	37.48
16	16-22 Apr	Stone Size	37.48	34.28	35.88
17	23-29 Apr	Stone Size	39.63	36.83	38.23
18	30 Apr-6 May	Stone Size	41.18	42.68	41.93
19	7-13 May	Fruiting	43.12	46.73	44.93
20	14-20 May	Fruiting	45.27	48.36	46.82
21	21-27 May	In Ripening	46.36	48.88	47.62
22	28 May-3 June	Rip/Harvest	48.52	50.26	49.39
23	4-10 June	Harvest	50.58	50.72	50.65
24	11-17 June	Harvest	52.42	54.58	53.50
25	18-24 June	Vegetative	46.22	48.22	47.22
26	25 June-1 July	Vegetative	44.28	46.00	45.14
27	2-8 July	Vegetative	42.72	44.56	43.64
28	9-15 July	Vegetative	42.12	40.83	41.48
29	16-22 July	Vegetative	40.88	38.42	39.65
30	23-29 July	Vegetative	40.24	38.08	39.16
31	30 July-5 Aug	Vegetative	38.46	36.28	37.37
32	6-12 Aug	Vegetative	37.24	35.46	36.35
33	13-19 Aug	Vegetative	36.92	33.82	35.37
34	20-26 Aug	Vegetative	36.18	32.34	34.26
35	27 Aug-2 Sep	Emerge New Flush	34.28	30.18	32.23
36	3-9 Sep	Emerge New Flush	32.56	30.82	31.69
37	10-16 Sep	Emerge New Flush	35.38	32.35	33.87
38	17-23 Sep	Emerge New Flush	36.52	34.82	35.67
39	24-30 Sep	Emerge New Flush	38.48	36.18	37.33
40	1-7 Oct	Emerge New Flush	38.92	36.72	37.82
41	8-14 Oct	Emerge New Flush	40.52	38.18	39.35
41	15-21 Oct	Emerge New Flush	41.36	38.8	40.08
43	22-28 Oct	Emerge New Flush	41.82	40.22	41.02
44	29 Oct- 4 Nov	New twigs	42.72	40.72	41.72
45	5-11 Nov	New twigs	42.88	41.47	42.18
46	12-18 Nov	New twigs	43.92	41.83	42.88
47	19-25 Nov	New twigs	44.08	42.58	43.33

Effect of abiotic factors on population build-up of leaf gall midge

The results based on correlation studies of leaf gall midge oriented leaf damage (Y) with major weather factors (X_1 to X_{10}) indicated significant positive correlation with sunshine (X_8)('r' = 0.3200, 0.4991 and 0.4214 during 2009-10, 2010-11 and in pooled results, respectively), however it was significant but negative with minimum temperature (X_2)('r'= -0.6396, -0.5771 and -0.5934), average temperature (X_3)('r'= -0.5290, -0.4847 and -0.4976), morning relative humidity (X_4) ('r' = -0.7611, -0.4736 and -0.5719), evening relative humidity (X_5) ('r' = -0.6232, -0.5488 and -0.5747), average relative humidity (X_6) ('r' = -0.6852, -0.5497 and -0.5874) and rainfall (X_9) ('r' = -0.4455, -0.5119 and -0.2985) in 2009-10, 2010-11 and pooled results, respectively (Table- 2).

Table 2. Correlation and regression coefficients of mango leaf gall midge damage with weather parameters

Weather parameters		Correlation coefficient ('r')			Regression coefficient		
		2009-10	2010-11	Pooled	2009-10	2010-11	Pooled
Maximum temp.	(X_1)	-0.0244	-0.0050	-0.0140	—	—	—
Minimum temp.	(X_2)	-0.6396**	-0.5771**	-0.5934**	-0.0663	-0.0103	1.0459
Average temp.	(X_3)	-0.5290**	-0.4847**	-0.4976**	0.0249	-1.0981	-2.8339
Morning Relative humidity	(X_4)	-0.7611**	-0.4736**	-0.5719**	-87.8139	-194.9628	-52.6196
Evening Relative humidity	(X_5)	-0.6232**	-0.5488**	-0.5747**	-87.2292	-194.8343	-52.6335
Average Relative humidity	(X_6)	-0.6852**	-0.5497**	-0.5874**	174.4309	389.7815	104.9645
Wind Velocity	(X_7)	-0.1073	0.0799	0.0012	—	—	—
Sunshine	(X_8)	0.3200*	0.4991*	0.4214**	-0.7345	0.3714	-0.5420
Rainfall	(X_9)	-0.4455**	-0.5119**	-0.2985*	-0.0207	-0.3714	0.0019
Evaporation	(X_{10})	0.1562	0.2700	0.2095*	—	—	2.8601
R^2		—	—	—	0.5670	0.3969	0.5007
Variation explained (%)		—	—	—	56.70	39.69	50.07
R		—	—	—	0.7915	0.6926	0.7345
Constant (A value)		—	—	—	103.7050	75.2048	110.0238

* Significant at 5 % level * * Significant at 1 % level

The multiple correlation coefficients (R) were significant (R = 0.7915, 0.6926 and 0.7345) in respective years and in pooled observations. The regression equations developed are:

2009-10:

$$\hat{Y} = 103.7050 - 0.0663 (X_2) + 0.0249 (X_3) - 87.8139 (X_4) - 87.2292 (X_5) + 174.4309 (X_6) - 0.7345(X_8) - 0.0207 (X_9)$$

2010-11:

$$\hat{Y} = 75.2048 - 0.0103 (X_2) - 1.0981 (X_3) - 194.9628 (X_4) - 194.8343 (X_5) + 389.7815 (X_6) + 0.3714 (X_8) - 0.3714 (X_9)$$

Pooled :

$$\hat{Y} = 110.0238 + 1.0459 (X_2) - 2.8339 (X_3) - 52.6196 (X_4) - 52.6335 (X_5) + 104.9645 (X_6) - 0.5420 (X_8) + 0.0019 (X_9) + 2.8601 (X_{10})$$

Where,

$\hat{Y}$ = Leaf damage (%)
X_2 = Minimum temperature
X_3 = Average temperature
X_4 = Morning relative humidity
X_5 = Evening relative humidity
X_6 = Average relative humidity
X_8 = Sunshine
X_9 = Rainfall
X_{10} = Evaporation

The regression analysis also explained total contribution of all the weather factors on seasonal cyclicity of leaf damage to the tune of 56.70, 39.69 and 50.07 per cent in 2009-10, 2010-11 and pooled observations, respectively.

So, looking to the impact of weather factors on overall abundance of mango leaf damage, it may be concluded that leaf midge damage was

Fig. 1 Pest calender of mango leaf gall midge (% leaf damage)

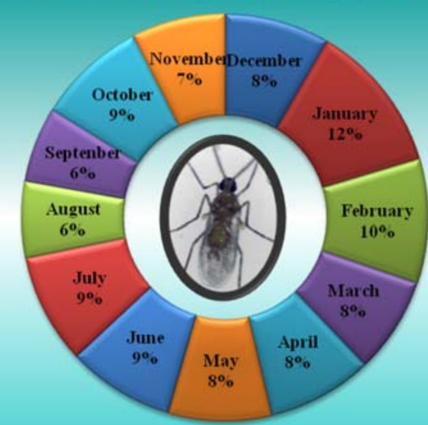
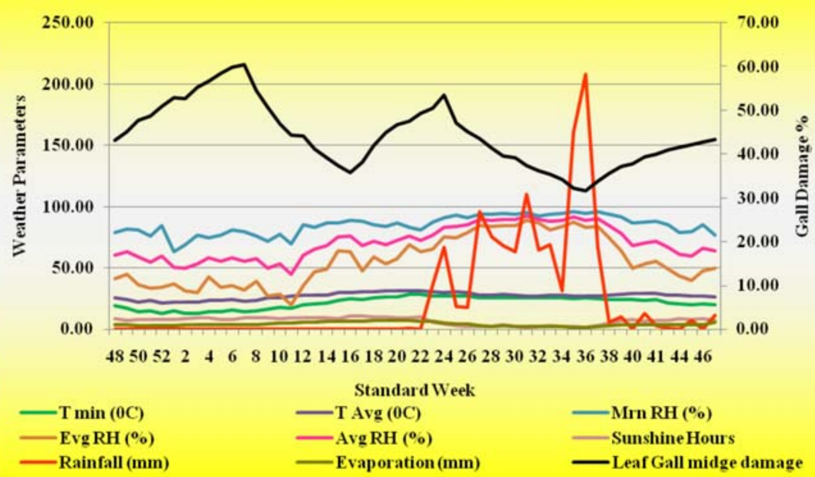


Fig. 2 : Impact of weather parameters on mango leaf gall midge population



directly influenced by sunshine implying higher the sun shine or longer the day length, higher was the leaf damage. Whereas, temperature (minimum and average), relative humidity (morning, evening and average), and rainfall had a negative impact indicating higher leaf damage when these factors had a minimum range and vice-versa. Patel *et al.,* (2011) reported leaf damage was directly influenced by sunshine, whereas relative humidity, temperature, rainfall and rainy days had a negative impact on their abundance. Kumar and Patel (2012) recorded highly significant positive correlation of sunshine hours with infestation of mango gall fly. Infestation was negatively correlated with temperature (minimum and average), relative humidity (Max., Min. and Av.), wind velocity, rainfall and rainy days. Jadhav *et al.* (2014) recorded infestation of mango leaf gall midge had significant positive correlation with sunshine hours. While, temperature, relative humidity, wind velocity and rainfall had significant negative correlation with the infestation of mango gall fly showed that when temperature, relative humidity, wind velocity and rainfall increased infestation of gall fly was decreased and vice-a-versa while, sunshine hours increased infestation of mango gall fly also increased and vice-a-versa. In the present investigation, the damage increased during 11-29 (12 March – 22 July), 18-25 (30 April – 24 June) and 18-26 SW (30 April-1 July).

REFERENCES

Butani, D.K. (1974). Insect pest of fruit crops and their control (Mango). Pesticides, 8 (3): 37-41.

Jadhav K.M., Patel R.K. and Gaikwad B.B. (2014) Population dynamics of mango gall fly, *Procontarina matteiana* and its correlation with weather parameters on different cultivars. Journal of Entomological Research, 38 (4) : 289-290.

Kumar S. and Patel A.T. (2012) Abundance of mango leaf gall midge in relation to major abiotic factors and crop stages International Conference on Agricultural & Horticultural Sciences Hyderabad International Convention Centre, India. Agrotechnology, 1: 1-2.

Patel A.T., Kumar S. and Chavan S.M. (2011) Screening of mango cultivars against leaf gall midge, *Procontarina matteiana* Kieffer and Cecconi (Diptera : Cecidomyiidae). Crop Improvement, 38: 99- 101.

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