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Seasonal Incidence and Relationship between Lunar Phases and the Emergence of *C. maculipennis*

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Abstract

The blossom midge *Contarinia maculipennis*, a serious pest in orchids which infests blooms and mainly hampered the cut flower production. The blossom midge *Contarinia maculipennis*, a serious pest in orchids which infests blooms and mainly hampered the cut flower production. Studies on seasonal incidence showed that *C. maculipennis* incidence was maximum during first fortnight of April 2018 (46.74 %) had positive correlation with maximum temperature and sunlight intensity under different shade net conditions and negative correlation with rainfall. Adult emergence in relation to lunar phases revealed that peak emergence was noticed during full moon (216.66 adults) and a day after (142.38 adults) which had positive correlation with per cent illumination.

***Keywords: Contarinia maculipennis*, emergence, lunar, seasonal, incidence**

1. Introduction

Orchids are the most elegant and colourful flowers widely used as cut flowers and decorative flowers. Orchids are the most important flowering plants valued for cut flower production due to their long lasting vase life and high price in the international market (Gupta, 2017). Among the orchids, *Dendrobium* spp. are the most popular tropical orchids widely used as cut flowers in the world (Sugapriya *et al.*, 2012) and occupies nearly 90 per cent of the area under orchid cultivation due to the advancement in management practices and availability of plant materials. In South India, Kanyakumari district of Tamil Nadu and Southern and Coastal district of Kerala are having the congenial climate for commercial cultivation of orchids.

Orchids are infested by different insect pests as that of other flowering and ornamental plants. The production of orchids is mainly hampered by the blossom midge, *C. maculipennis*. It is a polyphagous pest, causes severe damage by infesting the blossoms of dendrobium plants in orchid farms. The ovipositional injury by adults and feeding of larvae on flower buds leads to decaying of flower buds which cause considerable damage and inflicting severe yield loss to the growers. *C. maculipennis* has been recorded as an

important insect pest infesting the flower buds of *Jasminum sambac* Linn. in Andhra Pradesh (Thirumala Rao *et al.*, 1954) and *J. auriculatum* Vahl. in Tamil Nadu by David (1958) for the first time. Further, it is primarily a pest of hibiscus and dendrobium orchids, tomato, jasmine, plumeria, eggplant, pepper, bitter melon and many vegetables and ornamentals (Kawate and Sewake, 2014).

2. Materials and Methods

2.1. Studies on the seasonal incidence of blossom midge, C. maculipennis on orchids

Observations on the incidence of *C. maculipennis* were recorded from October 2017 to April 2018 on thirty randomly selected dendrobium plants at fortnight interval. The data on weather parameters *viz.*, maximum and minimum temperature (°C), relative humidity (%), sunlight intensity (lux) and rainfall (mm) were recorded at Rynco orchid farm, Thuckalay, Kanyakumari to study the influence of weather parameters on the incidence of *C. maculipennis*. The per cent damage due to infestation of *C. maculipennis* was assessed by recording the total number of buds and the number of buds showing midge damage symptoms from thirty randomly selected plants. Influence of weather parameters and their relationship on the incidence of *C. maculipennis* have been worked out using correlation and regression analyses.

2.2. Relationship between lunar phases and the emergence of C. maculipennis

The population dynamics of orchid blossom midge, *C. maculipennis* in relationship with lunar phases was studied under shade net conditions. Uniform sized midge infested flower buds were collected from the orchid farm and placed in glass bottles filled up with soil for pupation. Thirty buds were kept in each replication for daily observation on adult emergence. Three replicates were maintained throughout the study period. The adult emergence was recorded for five lunation period (1174 to 1178) *i.e.* from November 2017-April 2018. The moon phases and parameter of moonlight intensity (per cent illumination) data for Kanyakumari region was downloaded from website, www.timeanddate.com/moon/phases/india/kanyakumari and their dates are based on the Gregorian calendar (Annexure II). The lunation period was divided into thirty days as divisions. The recurrence of adult midge emergence falling into the diverse divisions of the moon phases were plotted against a graph for the relationship between lunar phases and emergence of the orchid blossom midges.

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3. Results and Discussion

3.1. Seasonal incidence of blossom midge, C. maculipennis on orchids in relation to weather parameters

Studies were carried out during October 2017 to April 2018 to know the influence of weather factors on the incidence of orchid blossom midge. The weather parameters *viz.*, maximum and minimum temperature, relative humidity, sunlight intensity under different shade net and rainfall were recorded.

The incidence of blossom midge ranged from 0.00 to 46.74 per cent during the entire study period (first fortnight October 2017 – second fortnight April 2018). The highest incidence of blossom midge was recorded during first fortnight of April 2018 (46.74%) with the corresponding maximum temperature of 34.11ºC, minimum temperature of 22.22 ºC, morning – evening relative humidity of 94.22 – 50.56 per cent, sunlight intensity under 35% shade net of 20600 lux, under 50% shade net of 19000 lux, under 70% shade net of 16450 lux and average rainfall of 6.25 mm. The incidence was minimum during the first fortnight of November 2017 (13.34 %) with the corresponding maximum temperature of 31.57 ºC, minimum temperature of 23.14 ºC, morning – evening relative humidity of 93.14 – 63.29 per cent, sunlight intensity under 35% shade net of 13756 lux, under 50% shade net of 12911 lux, under 70% shade net of 11536 lux and average rainfall of 21.58 mm (Table 1).

3.2. Simple correlation studies on blossom midge, C. maculipennis

Blossom midge, *C. maculipennis* incidence was significantly and positively correlated with maximum temperature (r = 0.731**), sunlight intensity under 35% shade net (r = 0.577*), sunlight intensity under 50% shade net (r = 0.566*), sunlight intensity under 70% shade net (r = 0.567*) whereas, average rainfall (r = -0.675**) was negatively significant correlation on the *C. maculipennis* incidence. However, the correlation of morning relative humidity (r = 0.108), minimum temperature (r = -0.098) and evening relative humidity (r = -0.370) was non-significant on the incidence of *C. maculipennis* (Table 2).

Studies conducted by Hemalatha (2009) gave a similar trend to that of present study where the blossom midge infestation was significantly higher during the summer months *i.e.* March to May and decreased during the month of June on jasmine. The present finding is in agreement with David *et al.* (1990), who reported that the blossom midge infestation was higher during summer months in jasmine.

Blossom midge, *C. maculipennis* incidence showed a significant positive correlation with maximum temperature and sunlight intensity under different shade net conditions but it had shown a significant negative correlation with rainfall. These findings are in line with Neelima (2005) and Merlin Kamala (2017), who revealed that the incidence of *C. maculipennis* on jasmine was positively correlated with maximum temperature and negatively correlated with the rainfall.

Influence of lunation period and the adult emergence of *C. maculipennis* showed that the peak emergence was occurred during full moon and a day after. The least emergence was noticed during new moon and a day before (Fig. 1). The emergence of adult midges might be associated with the lunar phases which are in agreement with the findings of Macdonald (1956) and Conlee (1955).

4. Conclusion

C. maculipennis incidence was highest during first fortnight of April 2018 (46.74 %) with corresponding weather parameters which had positive correlation with maximum temperature and sunlight intensity under different shade net conditions and negatively correlated with rainfall. Adult emergence in relation to lunar phases revealed that peak emergence was noticed during full moon and a day after. Meanwhile, the lowest adult emergence was observed during new moon and a day before which had positive correlation with per cent illumination.

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Table 1. Seasonal incidence of blossom midge, *C. maculipennis* on orchids

Month/ fortnight	Temperature (˚C)		Relative humidity (%)		Sunlight intensity (lux) under different shade net			Rainfall (mm)	Per cent incidence
	Max.	Min.	Morning	Evening	35%	50%	70%		
Oct I (2017)	31.88	23.75	93.25	65.25	18750	18100	15875	12.38	18.60
Oct II (2017)	31.46	23.38	93.62	66.08	22517	20633	18733	16.60	25.27
Nov I (2017)	31.57	23.14	93.14	63.29	13756	12911	11536	21.58	13.34
Nov II (2017)	31.50	22.30	92.10	64.00	24820	23080	19140	7.40	22.96
Dec I (2017)	30.25	21.90	94.10	63.70	0	0	0	92.00	0.00
Dec II (2017)	33.70	19.60	88.60	38.90	24360	20740	18880	2.00	31.12
Jan I (2018)	32.11	19.44	93.33	47.33	22271	21100	17900	1.50	24.66
Jan II (2018)	31.92	20.15	87.92	44.62	25420	22580	20220	3.00	16.34
Feb I (2018)	33.58	20.58	93.08	42.67	26675	23550	20063	12.75	28.82
Feb II (2018)	32.14	21.58	92.13	55.09	17857	16270	14235	0.00	37.13
Mar I (2018)	33.58	19.67	93.58	47.67	18836	17164	14982	10.00	35.60
Mar II (2018)	34.50	21.83	93.08	52.08	22943	20029	17329	3.00	32.66
Apr I (2018)	34.11	22.22	94.22	50.56	20600	19000	16450	6.25	46.74
Apr II (2018)	33.60	23.40	93.80	61.00	22700	20300	18100	14.50	39.42

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Table 2. Simple correlation and regression analysis on the incidence of blossom midge, *C. maculipennis* on orchids against weather parameters

Weather parameters		*C. maculipennis* incidence		
		'r' Value	(a)	(b)
Temperature (˚C)	Maximum	0.731**	-231.446	7.903
	Minimum	-0.098	43.525	- 0.781
Relative humidity (%)	Morning	0.108	-35.731	0.674
	Evening	-0.370	52.525	- 0.476
Sunlight intensity (lux) under different shade net	35 %	0.577*	5.845	0.001
	50 %	0.566*	5.760	0.001
	70 %	0.567*	5.547	0.001
Rainfall (mm)		-0.675**	31.711	- 0.351

** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2- tailed), (a = Intercept and b = Slope)

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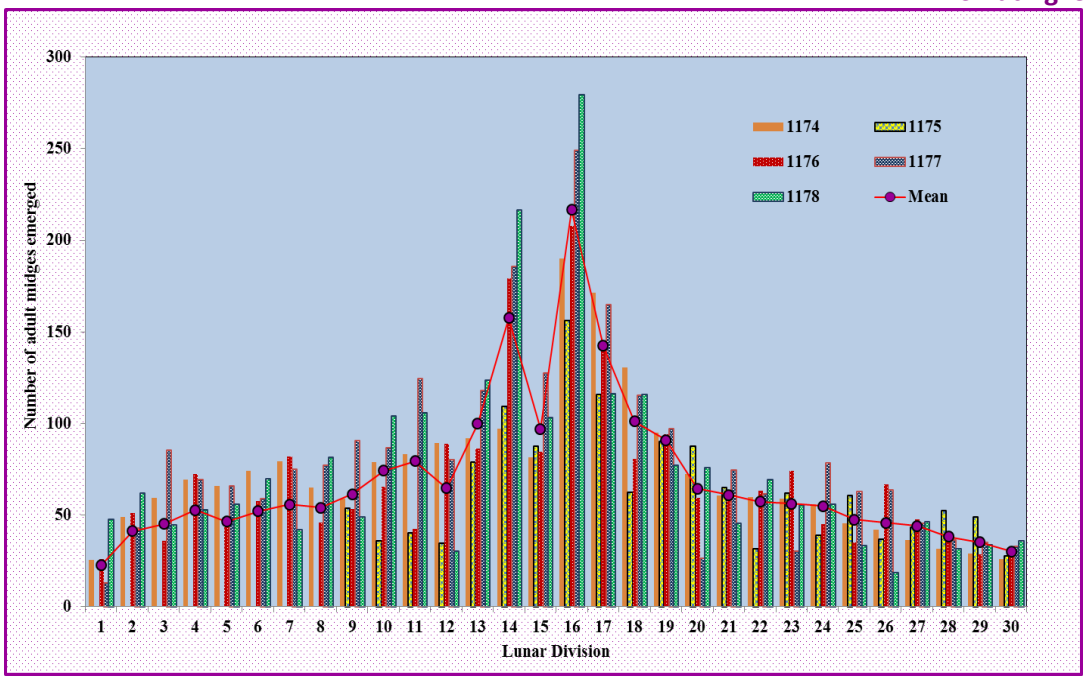

Fig. 1. Influence of lunar phase on the adult emergence of blossom midge, *C. maculipennis*

