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EFFECT OF STAGGERED SOWING ON THE INCIDENCE OF SORGHUM GRAIN MIDGE *CONTARINIA SORGHICOLA* (COQUILLETT)

Moulya M R*[1], Vijay Kumar L[1], Anil Kumar S T[2] and Keerthi M C[3]

[1]Department of Agricultural Entomology, UAS, GKVK Bengaluru 560065, Karnataka, India
[2]CSB, MESSO, P3 Unit, Narayanpur 784164, Assam, India
[3]Division of Crop Protection, ICAR- Indian Institute of Horticultural Research, Bengaluru 560089, Karnataka, India
*Email: moulyamr533@gmail.com (corresponding author): ORCID ID 0000-0003-1835-5654

ABSTRACT

Sorghum grain midge *Contarinia sorghicola* Coq. (Diptera: Cecidomyiidae) is the most destructive pest of grain sorghum. A field experiment was conducted to evaluate the effect of staggered sowing on the incidence in the southern Karnataka. A susceptible grain sorghum variety CSV- 23 was sown on five dates with fortnight intervals from April to June 2018. The crop sown during the second fortnight of April recorded a maximum incidence of midges (27.53 midges/ear head) on 25 MSW (Meteorological Standard Week). Delayed sowing during the second fortnight of June reduces the incidence of sorghum grain midge (2.07 to 9.50 midges/ earhead). Effect of abiotic factors on sorghum grain midge revealed a significant positive association with mean minimum temperature (r=0.36), mean morning (r= 0.39) and afternoon relative humidity(r=0.47) while mean maximum temperature (r=-0.40) and rainfall (r=-0.33) showed a negative correlation.

Key words: Abiotic factors, *Contarinia sorghicola*, correlation, grain midge, infestation, seasonal incidence, sorghum, population dynamics, weather parameters

Sorghum (*Sorghum bicolor* (L.) Moench) is an important cereal crop (Taylor, 2003). It is widely cultivated in arid and semi-arid regions of Africa, Asia, and South America (Young and Teetes, 1977; Hariprasanna and Rakshit, 2016). In India, it is grown in an area of 3.90 million ha with production of 4.23 mt 2021-22. Despite its significance, productivity and yield is low due to the incidence of insect pests (Sharma, 1985; Keerthi et al., 2017). Among the insect pests affecting sorghum, the sorghum grain midge, *Contarinia sorghicola* (Coquillett) (Diptera: Cecidomyiidae) is the most widespread and damaging (Young and Teetes, 1977). In Maharashtra at result in a 40-60% reduction in yield (Jotwani, 1982). Previously a minor pest, the midge has become a significant problem in southern Karnataka, especially in the Chamarajnagar area, over the past two decades. Studies have shown that changing the planting dates can reduce midge damage (Jotwani et al., 1976; Gowda and Thontadarya, 1977). There is limited information on the incidence and population dynamics of the midge. The relationship between crop pests and weather conditions plays a crucial role in pest incidence levels. In India, the seasonal occurrence of sorghum midge depends on climatic conditions (Patel and Jotwani, 1986). This study hypothesizes that varying sorghum planting dates will provide insights into insect incidence and peak activity of *C. sorghicola*.

MATERIALS AND METHODS

A field experiment was conducted at the Agricultural Research Station, AICRP, in Sorghum, Haradanahalli, Chamarajanagara, Karnataka (11°88'N, 76°95'E, 721 masl during 2018-19. The experiment involved sowing a popular and susceptible grain sorghum variety, CSV-23 (maturity duration 110-120 days), on five different dates (Seed rate – 12 kg/ ha) at fortnightly intervals from the second half of April to June 2018. Randomized Block Design with three replications and a spacing of 45x15 cm between rows and plants. All recommended agronomic practices were followed except for insecticidal sprays. Three blocks, each with a plot size of 4.5x 3.0 m, were maintained for each sowing date. Observations on the seasonal incidence and abundance of grain midge/ panicle were made 60 days after sowing (DAS) during the half-anthesis to grain maturity stage. Ten randomly selected panicles were bagged using 1000 ml (10x14 inches) polythene bags, and pest population data for each block was recorded and averaged for interpretation. For deciphering population dynamics.

To investigate the influence of meteorological variables weekly data were correlated (Pearson's rank correlation) with weather factors. This weather data was collected from the agrometeorological observatory unit at Krishi Vigyan Kendra, Chamarajanagara. Further analysis was conducted using the Multiple Linear Regression Analysis Technique (MLR; Panse and Sukhatme, 1967) with the software "SAS – Syntex Reference Guide 2016, version 16 (SPSS Software), South Wacker Drive, Chicago, IL."

RESULTS AND DISCUSSION

The crop sown during the second fortnight of April recorded the highest grain midge population, peaking at 27.53 midges/ earhead during the 25th MSW. Subsequent weeks (26, 27, and 28 MSWs) saw populations of 26.10, 24.67, and 17.40 midges/ ear head, respectively. By the 29th, 30th, and 31st MSWs, the population declined to 9.63, 6.60, and 6.30 midges per plant. Similarly, crops sown on May 15 showed peak populations during the 29th, 30th and 31st MSWs at 26.53, 26.23, and 25.30 midges/ plant, then declined from the 22nd MSW. For crops sown in late May, the midge populations during the 31st, 32nd, and 33rd MSWs were 21.37, 19.27, and 15.80 midges/ plant, declining from the 34th MSW. June-sown crops had lower midge incidences, which drastically decreased from the 36th MSW, reaching 2.27 midges per plant by the 39th MSW. Among all sowing dates, the crop sown in the second fortnight of June recorded the lowest midge populations, ranging from 20.7 to 9.50 midges. These findings provide a comprehensive understanding of grain midge behaviour and population dynamics, particularly their preference for the half-anthesis stage for egg-laying and larval activity, with higher activity in early sown crops (25-35 MSWs). Populations across all sowing dates declined significantly from the 36th MSW, ranging from 2.07 to 5.63 midges/ plant (Table 1).

From June to late October (25-41 MSWs), peak was in June and July and declining from August onwards (31st MSW). These findings align with those of Gowda and Thontadarya (1977), who reported maximum infestations in June, and Patel and Jotwani (1986), who recorded the highest infestation in early July. Similarly, Kausalya et al. (1997) found peak activity in early July. Across different sowing dates, midge activity was restricted to the ear head emergence to the half-anthesis stage. The grain midge population significantly correlated with mean minimum temperature (r=0.36) and mean morning and afternoon relative humidity

Table 1. Seasonal incidence of sorghum grain midge, *C. sorghicola* in relation to abiotic factors, kharif 2018

Dates of sowing	MSW	Midges/ 10 earhead
15 April	25	27.53
	26	26.10
	27	24.67
	28	17.40
	29	9.63
	30	6.60
	31	6.30
15 May	29	26.53
	30	26.23
	31	25.30
	32	16.80
	33	7.93
	34	6.60
	35	3.87
30 May	31	21.37
	32	19.27
	33	15.80
	34	10.63
	35	5.17
	36	3.93
	37	3.07
15 June	33	15.27
	34	14.67
	35	11.40
	36	7.60
	37	4.60
	38	3.07
	39	2.27
30 June	35	9.50
	36	5.63
	37	5.47
	38	3.87
	39	2.43
	40	2.23
	41	2.07

MSW: Meteorological Standard Week, the meteorological data was taking from Krishi Vigyan Kendra, Chamarajarajanagara during study period

(r=0.39 and r=0.47, respectively). Conversely, there was a significant negative correlation between mean maximum temperature (r=-0.40) and rainfall (r=-0.33). The number of rainy days showed a negative but non-significant correlation with the midge population (r=-0.16, Table 2). These results differ from Jotwani et al. (1976), who found a positive association with maximum temperature.

Other studies by Natarajan and Chelliah (1985), Mote and Ghule (1986), Sharma et al. (2003), and Anandhi et al. (2017) reported a significant positive association with grain midge incidence. However, this study's significant negative association with maximum temperature might be due to regional differences in sowing times and agronomic practices. The findings of this study regarding minimum temperature and relative humidity are consistent with those of Sharma et al. (2003) and Anandhi et al. (2017). Morning and afternoon relative humidity positively correlated with

Table 2. Relationship between incidence of grain midges vs weather factors (kharif, 2018)

Parameters	X_1	X_2	X_3	X_4	X_5	X_6	R^2 value
Y – Grain midge population	-0.40*	0.36*	0.39*	0.47*	-0.33*	-0.16*	
X_1 – Maximum temperature	1.00	0.31	0.21	-0.82	-0.36	-0.23	
X_2 – Minimum temperature		1.00	-0.76	0.06	-0.23	-0.14	
X_3 – Morning relative humidity			1.00	0.28	0.43	0.57	0.23
X_4 – Afternoon relative humidity				1.00	0.13	0.34	
X_5 – Rain fall					1.00	0.90	
X_6 - No. of rainy day						1.00	

N =16; *Significance at p = 0.05 ** Significance at p = 0.01

midge activity, aligning with Jotwani et al. (1976), Fisher and Teetes (1982), Mote and Ghule (1986), and Sharma et al. (2003). However, Anandhi et al. (2017) reported a negative association with relative humidity, possibly due to geographical variations. Rainfall showed a significant negative association with midge activity, consistent with Jotwani et al. (1976), Fisher and Teetes (1982), and Anandhi et al. (2017). However, Mote and Ghule (1986) found contrasting results, likely due to differences in rainfall intensity and distribution, indicating a need for long-term data for more reliable conclusions. These findings underscore the importance of ongoing research and the need for comprehensive, long-term data to understand and manage grain midge populations effectively.

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AUTHOR CONTRIBUTION STATEMENT

All authors contributed equally.

CONFLICT OF INTEREST

No conflict of interest.

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