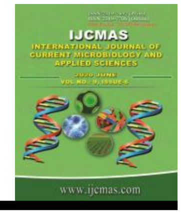
Int.J.Curr.Microbiol.App.Sci (2020) *9*(6): 4037-4043

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 6 (2020)**
Journal homepage: http://www.ijcmas.com



Original Research Article https://doi.org/10.20546/ijcmas.2020.906.472

Influence of Abiotic Factors on the Shootfly (*Atherigona pulla* Wiede) Infestation

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ABSTRACT

Keywords

Little millet, Shootfly, *Atherigona soccata*, Weather parameter, Abiotic factor

Article Info

Accepted:
30 May 2020
Available Online:
10 June 2020

A field trial was conducted at little millet research plot of Birsa Agricultural University, Kanke, Ranchi during *Kharif* season of 2017, in order to find the effect of abiotic factor ofimportant abiotic factors on the incidence of shoot fly in little millet var BG1.Maximum infestation of *Atherigona pulla* was observed in the 3rd week after germination (i.e.,3rd week of July)when the maximum and minimum temperature, RH at 7 AM and at 2 PM and rainfall was 29.5,21.0, 84.6 per cent, 71.6 per cent and 56.1 mm, respectively and lowest dead heart was observed at one week after germination. Maximum temperature (r= 0.649854), RH at 7 AM (r= -0.17913) and at RH 2 PM (r= -0.58671) had negative correlation with dead hearts caused by *A. pulla*.

Introduction

Little millet is scientifically known as *Panicum sumatrense* (*miliare)* (Rolk Roem and Schult). Millets are one of the oldest foods known to humans and its grain was possibly the first used for domestic purpose. Millets are important crops in the world agriculture economics, used both as for food for human and feed for animals. Due to capability of withstanding draught conditions, it is a good choice for those areas where rainfall is meagre or very little to moderate in India. Total millet production in 2010 in India was 10.94 MT with the productivity of 9513 hectogram per hectare (FAO, 2011)[6]. In Jharkhand, it is known by Gundli. Before the division of Bihar, Gundli was a popular crop in southern part of Bihar (now Jharkhand), particularly among the rural and tribal people. In Jharkhand, little millet crop is grown in Kharif season. Due to its high nutritional values, now-a-days, this crop is a good choice among the urban and elite group of people. It is a short duration crop, takes about 65 to 75 days, depending on the variety cultivated. Often, little millet serves as a food and contributes to the nutritional security of small and marginal farmers who live in remote areas. According to Kulkarni *et al.,* 1992[10], Hadimani and Malleshi, 1993[7] and Itagi, 2003[8] the grain compares well with other cereals. It has a fair source of protein (7.70 to 16.50 %), Fat (2.45 to 9.04 %), Carbohydrate (62.50 to 76.30 %) and is an excellent source of dietary fiber (15.90 to 18.10) with good amount of soluble (3.15 to 5.70) and insoluble (10.20 to 14.95 %) fraction. Shootfly is a dominant pest among several pests attacking the little millet (Jotwani *et. al.,* 1969)[9]. The shootfly ranks first among the insect pests that attack little millet and often resulting in per cent loss to the crop (Anonymous, 1991)[1]. Peak period of activity of shootfly species, viz., *Atherigona socaata* Rondani and *A. naqvii* Steyskal was determined when 20 and 14 different maize germplasm were sown during spring 1981 and 1983, the first sowing commencing from 18th/17th February followed by seven sowing at weekly intervals, viz., 25th/24th February, 4th/3rd March, 11th/10th March, 18th/19th March, 25th/24th March, 1st April/31st March and 8th/7th April, respectively. On the basis of number of eggs laid by *A. soccata* on the foliage and stalk by *A. naqvii* in the cracks and crevices in the soil around the seedlings as also dead hearts produced, their peak period of activity was observed in crop sown from 3rd week of February to 1st week of March. *A. naqvii* laid more number of eggs on/in soil as against *A. soccata* on leaves and stalk of the plant. Regardless of sowing dates, EVA 605 received less number of eggs and low percentage of deadhearts in both the years (Marwaha, 1984)[12].

The temperature range between 25º to 30ºC and relative humidity between 60 to 90 per cent were worked out to bethe optimum conditions for the development of shootfly. However, the best combinations were found to be 30 and 90 per cent R. H (Doharey *et al.,* 1977)[5].Mahapatra and Dhir (1994)[11] reported that the attack of shootfly is more severe in case of late sowing as compared to early sown (before 21st July) of little millet. The grain yield response of *rabi* sorghum to sowing date was in favour of early sowing (15th September to 15th October) rather than late sowing (beyond 1st November) (Chorge and Ramshe 1990[2]). Dahatonde and Moghe (1991)[4] who recorded a grain yield level of 1.22 t/ha (27th September, sowing) compared to 0.81 t/ha (27th October sowing) with no significant effect of sowing date on fodder yield or test weight. Time of sowing has been found to be of great significance in reducing the level of damage by shootfly in the monsoon season. This observation is generally related to the fact that shootfly populations remain very low during the hot and dry season and the beginning of the following rainy season (Starks, 1970)[15].

Materials and Methods

Experimental site

Afield trials were carried out at Small Millets Research plots of Ranchi Agriculture College under Birsa Agricultural University, Kanke, Ranchi, during *kharif,* 2017-2018 situated at the 23⁰17' North latitude and 85⁰19' East longitude with an altitude of 625 meters above mean sea levelhaving sub-tropical climate. The location fall under Agro-climate zone of Central and Western Plateau Zone with an average annual rainfall of 1400mm per year.Weekly meteorological data on temperature, rainfall and relative humidity were obtained from the meteorological observatory records maintained in the Department of Agricultural Physics and Meteorology, Birsa Agricultural University, Ranchi.

Under the present experiment, the shootfly incidence was recorded on the variety BG1.

For that ten plants were selected in all the three replications in the control plots under the insecticidal experiment. The egg count of shootfly was recorded at weekly intervals starting from fourteen days after germination and continued up to eight weeks after germination of plants. Weekly meteorological data on temperature, humidity and rainfall were obtained from the Department of Agricultural Physics and Meteorology, Birsa Agricultural University, Kanke, Ranchi. The data collected on temperature, humidity and rainfall from 27^{th}standard week, 2017 to 34^{th}standard week, and 2017 were finally correlated with shootfly egg count and its incidence as well by using the formula given below:

Correlation coefficient (r) =∑xy-(∑x)(∑y)/n

Results and Discussion

To estimate the nature and degree of relationship between egg count per plant and dead heart percentage with weather variable *viz.*, temperature (maximum and minimum), relative humidity (morning and afternoon) and the rainfall, correlation studies have been done. The results obtained on the correlation between infestation due to shootfly and weather parameters are given here under (Table-1 and Fig. 1).

Number of eggs

The mean egg count of *A. pulla* Wiede was ranged from 0.25 to 0.63 eggs per plant from 7 to 56 days after germination. The mean egg count was 0.78 egg per plant while the maximum egg count was observed at three week after emergence (3^{rd} week of July) when the weather parameters like maximum and minimum temperatures, relative humidity at 7 AM and 2 PM and rainfall was 29.5^{0}C, 21.0 ^{0}C, 84.6 per cent, 71.6 per cent, and 56.1 mm, respectively. The correlation analysis indicated that maximum temperature (r= -0.45634), RH 7AM (r=0.038225), and RH 2PM (r= 0.621393) negatively influenced the count of *A. pulla* meaning there by an increase in maximum temperature and relative humidity (7AM) resulted in falling in egg count of *A. pulla*. However, the RH at 2 PM had a significant high positive correlation with egg count (0.0621393). Except for these factors, there was no influence of other weather parameters on the egg count of *A. pulla* infesting little millet (Table no. -2).

Fig.1

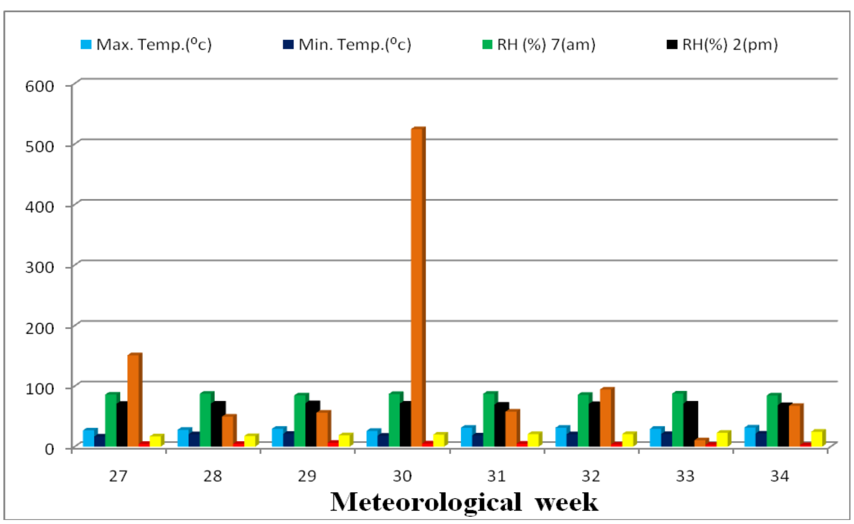

Table.1 Weekly weather condition during the experimental period

Meteorological Weeks. 2017	Period	Temperature (°C)		Relative humidity (%)		Rainfall (mm)
		Max. Temp. (°C)	Min. Temp. (°C)	7 am	2 pm	
27	2nd Jul-8th Jul	26.8	16.6	86	70.6	151
28	9th Jul-15th Jul	27.8	20.4	87.4	70.9	49.5
29	16th Jul-22nd Jul	29.5	21.0	84.6	71.6	56.1
30	23rd Jul-29th Jul	25.9	18.0	86.9	71.1	524.6
31	30th Jul-5th Aug	31.2	18.3	87.3	68.4	57.7
32	6th Aug- 12th Aug	31.1	20.4	85.6	70.4	94.3
33	13th Aug- 19th Aug	29.5	20.7	87.7	71.1	10.5
34	20th Aug- 26th Aug	31.5	21.6	84.4	68.6	67.3

Table.2 Influence of weather parameters, temperature and relative humidity on the incidence (egg counts and dead hearts formation) of shoot fly in little millet

Meteorological week	Weather parameter						
	Max. Temp. (°C)	Mini. Temp. (°C)	RH (%) 7 AM	RH (%) 2 PM	Rainfall (mm)	Eggs /10 Plants	Dead heart(%)
27	26.8	16.6	86.0	70.6	151.0	4.5 (2.23)*	16.8 (24.20)**
28	27.8	20.4	87.4	70.9	49.5	4.7 (2.28)	17.4 (24.65)
29	29.5	21.0	84.6	71.6	56.1	6.3 (2.60)	18.6 (25.55)
30	25.9	18.0	86.9	71.1	524.6	5.2 (2.38)	19.8 (26.42)
31	31.2	18.3	87.3	69.4	57.7	4.8 (2.30)	20.6 (26.99)
32	31.1	20.4	85.6	70.4	94.3	3.6 (2.02)	20.7 (27.06)
33	29.5	20.7	87.7	71.1	10.5	3.2 (1.92)	22.8 (28.52)
34	31.5	21.6	84.4	68.6	67.3	2.5 (1.73)	24.6 (29.73)

** Figures in parentheses are √arc sine transformed value.
*Figures in parentheses are √X+0.5 transformed values.

Table.3 Correlation co-efficient between weather variables and egg/ 10 plants and dead heart percent during *Kharif*, 2017

Observation	Weather parameter				
	Max. Temp. (^{0}C)	Mini. Temp. (^{0}C)	RH (%) 7 AM	RH (%) 2 PM	Rainfall (mm)
Eggs/ 10 plants	-0.45634	-0.33308	0.038225	0.621393	0.295544
Dead heart	0.649854	0.550732	-0.17913	-0.58671	-0.16961

Significance level 0.05 0.01
Significant at 1% Significant at 5%

Per cent dead heart

The per cent of dead heart varied from 16.86 to 24.66. Maximum infestation of *A. pulla* was observed in the 3rd week after germination (i.e.,3rd week of July)when the maximum and minimum temperature, RH at 7 AM and at 2 PM and rainfall was 29.5,21.0, 84.6 per cent, 71.6 per cent and 56.1 mm, respectively and lowest dead heart was observed at one week after germination. A gradual increase in dead heart was noticed starting from one week of germination Table.1.

The result on correlation studies with weather variables indicated that maximum temperature (r= 0.649854), RH at 7 AM (r= -0.17913) and at RH 2 PM (r= -0.58671) had negative correlation with dead hearts caused by *A. pulla*. There was decline in dead hearts when the maximum temperature and RH at 7 AM increased. However, an increase in shoot fly infestation was noticed with the increase in RH at 2 PM. The correlation studies also revealed that apart from these three weather factors, the other weather variables did not influence the dead hearts caused by *A. pulla* in little millet (Table.2).

In general on rainfed sorghum, the fly activity begins to increase at the onset of the rains coinciding with planting of the crop in June. The population is held at a low level during the preceding dry season due to high temperatures and low humidity and the absence of host plants. As the first crop begins to grow, low populations of flies migrate to it depositing the eggs that produce the following generation. Three to four weeks later a second generation begins to emerge so that later plantings are severely attacked (Clearwater and Othieno.1977)[3]. Narayan and Narayan (1967)[13] reported that maximum shootfly damage was on the crop sown during August-September but the incidence was less on the crop sown during January- February and June-July at Warangal in Andhra Pradesh India. Rao and Rao (1956)[14]suspected that the fly attack is positively correlated to lower temperature as high humidity and also the existence of sorghum crop which is already attacked by the pest.

The maximum egg count per plant observed at three week after emergence (3rdweek of July). The results obtained revealed that the egg count of the shootfly, *Atherigona pulla* were significantly and negatively correlated with the maximum temperatures and RH 7 AM and it was significantly and positively correlated with RH at 2 PM. Except for these three factors, there was no influence of other weather parameters on the egg count of *A.pulla* infesting little millet. The per cent of dead hearts varied from 16.86 % to 24.66%. Maximum infestation of *A. pulla* was observed in the 3rd week after germination (i.e.3rd week of July). There was decline in deadhearts when the maximum temperature and RH at 7AM increased. However, an increase in shootfly infestation was noticed with the increase in RH at 2 PM.

Acknowledgements

Authors are thankful to the hon'ble Vice-Chancellor, the Director of Research and the Dean (Agriculture), Birsa Agricultural University, Kanke, Ranchi for providing facilities, support and moral encouragement for conducting this filed experiment.

References

Anonymous. Annual progress report All India coordinated Research Project on small millets. Rajendra Agricultural University, Bihar Trihut college of Agriculture, Dholi. In Cooperation with ICAR.1991.

Chorge, B. M and Ramshe, D.G. 1990. Effects of sowing dates on yield attributes, yield, nutrient uptake and protein content of *rabi* sorghum under irrigations. *J.Maharashtra Agric*, Univ., 152:142 - 145.

Clearwater, J. R. and Othieno, S. M. 1977. Population dynamics of *Atherigona soccata* in the field, in ICIPE Fifth Annual Report Nairobi, pp 14-16.

Dahatonde, B.N. and Moghe P. G. 1991. Performance of rainfed winter sorghum nitrogen under conventional and improved technology in semi - arid tropics. *Sorghum Newslett*.25:60.

Doharey, K.L., Srivastava, B.G., Jotwani, M.G. and Dang, K. 1977. Effect of temperature and humidity on the development of *Atherigona soccata* Rondani. *Indian J.Ent*. 393 :211-215.

FAO, 2011. Food and Agriculture Organization of the United Nations, Statistical Database internet website: www.fao.org

Hadimani, N. A. and Malleshi, N. G. Studies on Milling, Physico-chemical Properties, Nutrient Composition and Dietary Fibre Content of Millets. Journal of Food Science and Technology (India). 1993;30 (1): 17-20.

Itagi, S. K..Development and evaluation of millet based composite food for diabetics. College of Rural Home Science, U A S Dharwad. 2003;19 (I).

Jotwani M.G..Investigations on insect pests of sorghum and millets with special reference to host plant resistance. Final Technical Report 1972-77. Project A7-ENT-1201 Indian Agricultural Research Institute New Delhi. 1978; 114.

Kulkarni, K. A., Bhuti, S. G., Gowda, B. T. S. and Parameshwarappa. Relation between glossyness and plant vigour and shoot fly incidence in sorghum genotypes. Sorghum Newsletter. 1981; 24: 72.

Mahapatra, H.K. and Dhir, B.C. 1994. Effect of Sowing Time on Incidence of Shootfly, *Atherigona miliaceae* in Little Millet. *Indian Journal of Plant protection*,, 22(1): 9-13.

Marwaha, K.K., Siddiqui, K.H. and Panwar, V.P.S. 1984. Differential reaction of promising maize germplasms to shoot fly species *Atherigona soccata* Rondani and *A.naqvii* Steyskal in spring season. *J. Ent. Res.*121:41-44.

Narayan, K. and Narayan, D. 1967. Observations on the incidence of shootfly. *Sorghum Newsl*. 10: 37- 38.

Rao, S.B.P. and Rao, D.V.N. 1956a. Studies on the sorghum shoot borer fly *Atherigona indica* Molloch (Anthomyiidae: Diptera) at Siruguppa. *Mysore Agric. J*. 31:158-174.

Starks, K.J. 1970. Increasing infestations of the sorghum shootfly in experimental plots. *J. econ. Ent*. 63(5):1715-1716.

How to cite this article:

Kamal Kartik Kenny Kundra, M. K. Chakravarty and Alka Kumari 2020. Influence of Abiotic Factors on THE Shootfly (*Atherigona pulla* Wiede) Infestation. *Int.J.Curr.Microbiol.App.Sci.* 9(06): 4037-4043. doi: https://doi.org/10.20546/ijcmas.2020.906.472