

Spatial Distribution of Shoot Fly, *Atherigona soccata* (Rondani) on Sorghum with Respect to Different Dates of Sowing

Dilbag Singh Ahlawat^{1*} & Dalip Kumar²

¹CCS HAU, Regional Research Station, Rohtak-124001, India. E-mail: ahlawatento@gmail.com*

²Department of Entomology, CCS HAU, Hisar-125004, India.

DOI: <http://doi.org/10.38177/ajast.2021.5309>

Copyright: © 2021 Dilbag Singh Ahlawat & Dalip Kumar. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Article Received: 26 May 2021

Article Accepted: 28 July 2021

Article Published: 30 August 2021



ABSTRACT

An investigation was carried out to know the incidence of shoot fly on sorghum during year 2018 and 2019 in *Kharif* season at Research farm, CCS Haryana Agricultural University, Regional Research Station, Rohtak (India). Incidence of shoot fly was found to be higher in 15th to 30th July sown crops. It is evident from the pooled data for both the years (2018 and 2019) that the crop sown on 15th June, showed significantly lowest per cent of dead heart incidence (5.20 and 8.00 (pooled) by shoot fly at 14th and 28th days after crop emergence, respectively. Whereas, the crop sown on 30th July, 2018-19 showed significantly higher per cent of dead heart incidence *i.e.*, 21.60 and 32.80 (pooled) at 14th and 28th days after crop emergence, respectively. Significantly, maximum yield of 10.82 q/ha was obtained in case of crop sown on 15th June, while lowest yield of 2.24 q/ha when crop sown on 30th July. As the sowing was delayed beyond 30th June the incidence increased while yield decreased significantly. In the present study, it was found as the sowing was delayed the shoot fly incidence increased and the grain yield decreased.

Keywords: Sorghum, Shoot fly, Incidence, Seed yield, Sowing date.

Introduction

Sorghum [*Sorghum bicolor* (Linn.) Moench] is one of the most important cereal for human food and animal feed crops of the world particularly in the developing world, adapted to a wide range of ecological conditions and includes both cultivated and wild species, suitability for low input cultivation and diverse uses (Doggett, 1970). Sorghum yields are pathetically low ranging from 500 to 800 kg/ha in Africa and Asia. The productivity of sorghum in India is 849.05 kg/ha, is well below the world's average (1444.6 kg/ha). In India, a total of 3.47 million tons of sorghum grains were produced over the acreage of 4.07 million hectares during 2020 (FAO, 2021). In it is this ability to give a utile yield of grain under difficult agronomic conditions which makes sorghum such a valuable cereal (Satyagopal *et al.*, 2014).

There are over 150 insect species known to damage sorghum plant from germination to crop harvest (Seshu Reddy and Davies, 1979). Insect-pests in sorghum cause nearly 32.0 per cent of the total loss to the actual produce in India (Borad and Mittal, 1983), 20.0 per cent in Africa and Latin America, 9.0 per cent in USA (Wiseman and Morrison, 1981). Added introduction of high-yielding hybrids of sorghum that is highly susceptible to shoot fly that induced the problem to become even more grievous situation (Jotwani 1981).

Among the insect-pests, the shoot fly (*Atherigona soccata* Rondani) is one of the most important and destructive pest which causes considerable losses in fodder as well as grain yield. Due to introduction of improved sorghum varieties and continuous cropping pattern, it has become a principal pest of the sorghum. This pest attacks on the sorghum crop at seedling stage causing maximum damage during the rainy season. The larva of this pest attacks on central whorl of the plant and causes dead heart formation. Various control tactics have been suggested for the management of this pest; however the sorghum crop grown early or timely can easily escape the incidence of this

pest. Advancing different date of planting certainly returns good yield and, that also eliminates shoot fly attack; most sorghum pests can be avoided.

Material and Methods

A field experiment was carried out during crop season *Kharif*, 2018 and 2019 at Research farm of CCS HAU, Regional Research Station, Rohtak (India). Sorghum variety, HJ 541, was sown on four different dates (15 June, 30 June, 15 July and 30 July) following the recommended agronomic practices (Anonymous, 2017) except the plant protection measures in randomized block design with five replications in plot size of 3 x 5 m². Incidence of shoot fly was recorded at seedling stage on 14th and 28th day after crop emergence. At each observation, twenty-five plants were selected randomly from two middle rows from each plot and per cent incidence was calculated. The plants showing dead hearts were counted and removed to avoid recounting.

Statistical analysis

The data pertaining to incidence and seed yield were subjected to statistical analysis by using standard analysis of variance (ANOVA) as per procedures of Sheoran *et al.*, 1998.

Results and Discussions

Plant resistance plays an integral part in integrated pest management of field crops. Simultaneously, it has become increasingly important to understand the interactions between insect-pests and host plants for building foundation of breeding programme for resistance. The data on shoot fly incidence and grain yield have been presented in table 1. The sorghum variety HJ 541 was tested for natural incidence of shoot fly, *Atherigona soccata* (Rondani) under field condition selecting four different sowing dates (15th June, 30th June, 15th July and 30th July).

At 14 days after emergence of sorghum crop

There was significant difference in per cent of dead hearts due to the presence and or invasion of sorghum shoot fly when sown on 15th June (4.80 %) compared to 15th (13.60 %) and 30th July (20.00%), while it was found at par when crop sown on 30th of June (7.20 %) in *Kharif* season year 2018.

Per cent dead heart incidence caused by shoot fly was recorded minimum when sorghum crop sown on 15th of June in crop year 2019 *i.e.*, 5.60 per cent that was at par with 8.0 per cent of 30th June sown crop. Significant differences were apparent in number of dead hearts when crop sown on 15th of June than 15th (14.40 %) and 30th July (23.20 %) of crop season of *Kharif*, 2019. There were substantial differences in dead hearts when crop rose in field at 30th July in both the *Kharif* season of year 2018 and 2019 as compare to crop when sown in field at dated 15th and 30th June and 15th July.

At 28 days after emergence of sorghum crop

Although dead hearts caused by shoot fly was recorded minimum when sorghum crop sown at 15th of June (7.20%) that was found to be at par with crop sown on 30th of June (12.00 %), but it differed significantly when crop sown on 15th of July (19.20 %). However, sorghum crop sown on 30th of June (12.00 %) found at par with crop sown on 15th of July (19.20 %) that differed significantly with crop of 30 July having 32.00 per cent dead heart in *Kharif*, 2018.

Maximum numbers of dead heart (33.6 %) were observed when sorghum crop sown on 30th of July while least number of dead heart recorded when crop planted on 30th of June (8.80 %). Significant differences in number of dead hearts were registered when sorghum rose at distinctly separate fortnight interval. Moreover there was increasing trend in number of dead hearts as sowing date of crop is delayed from 15th of June to 30th of July.

Yield realized by crop sown at 15th and 30th June found to be at par in year 2018*i.e.*, 10.85 and 9.07 q/ha, respectively; however minimum of yield (2.42 q/ha) obtained in crop sown on 30th of July in *Kharif* 2018. Minimum yield (2.23 q/ha) was obtained in crop when sown on dated 30th of July in *Kharif* of year 2019, whereas maximum yield (10.79 q/ha) recorded in sorghum crop delayed. Significant differences in yield were apparent when crop is sown at different dates in *Kharif* 2019 year. It is to be learned in the present study that beyond 30th June the incidence of shoot flies increased, while grain yield decreased significantly (Table 1).

Ameta and Sumeria (2004) also found that as the sowing of sorghum was delayed, the infestation of shoot fly increases and adversely affected the plant height, weight and length of earhead and grain yield. In an experiment, Pavani *et al.* (2019) concluded that the egg laying by the pod borer, *Helicoverpa armigera* decreased across sowing dates from October to December in chickpea crop. In maize, Ullahet *al.* (2010) registered minimum per cent infestation (1.39) in plot sown in the 3rd week of July instead of plots sown in 2nd week of July recorded the highest (4.82) suggests that the percent infestation of maize stem borer, *Chilo partellus* can be minimized by sowing the crop in mid July. Salman and Abdel-Moniem (2008) tested twenty maize hybrids against shoot fly incidence with respect to sowing dates may be maneuvered with a proper cultivating date for maize hybrids as it not only brought about reduction in infestation, but was also a good method to reduce insecticidal application to control shoot fly. Incidence and population fluctuation in variety of insect pests very much dependent on the prevailed climatic conditions of the cropping season in mung bean, thus insect pests attacking mung bean crop can be manipulated by sowing at different dates (Hossain *et al.*, 2009).

Authors further added that early and late sown crops received higher pest infestation than mid sown crops. Kethran *et al.* (2014) also inferred that early sowing of chilli crop *i.e.*, in January 15th or January 30th resulted in lower incidence of aphids, thrips, whitefly and fruit borer except mites and such low level of insect pest caused less crop injury which resulted in enhancing the green pod yield of chilli. Sathish *et al.* (2017) observed higher incidence of shoot fly in 15th July to 1st August (20.93 % dead hearts) sown proso millet crops, whereas low incidence (0.59 % dead hearts) was transcribed when crop sown on 1st May.

Table 1. Effect of date of sowing on the incidence of shoot fly, *Atherigona soccata* (Rondani) in sorghum crop

Date of sowing	Per cent incidence						Seed yield (q/ha)		
	14 DAE			28 DAE			2018	2019	Pooled (2018-19)
	2018	2019	Pooled (2018-19)	2018	2019	Pooled (2018-19)			
15 June	4.80 (12.51)	5.60 (13.57)	5.20	7.20 (15.23)	8.80 (17.09)	8.00	10.85	10.79	10.82

30 June	7.20 (15.23)	8.00 (16.16)	7.60	12.00 (19.98)	13.20 (21.10)	12.60	9.07	8.89	8.98
15 July	13.60 (21.58)	14.40 (22.06)	14.00	19.20 (25.81)	21.6 (27.63)	20.40	6.20	5.94	6.07
30 July	20.00 (26.40)	23.20 (28.69)	21.60	32.00 (34.35)	33.6 (35.39)	32.80	2.42	2.23	2.24
C.D. (p=0.05)	4.62	3.28		5.96	3.62		2.50	0.88	
CV	17.51	10.69		17.92	13.73		11.99	4.26	

Figures in parentheses are square root transformation, DAE= Days after emergence

Conclusion

Field experiment was conducted at CCS HAU, Regional Research Station, Rohtak during *Kharif* season of year 2018 and 2019 to know the effect of sowing dates on the incidence of shoot fly in sorghum. Made an endeavour to find out the suitable date of sowing to minimize the incidence of shoot fly in sorghum crop.

From the present study, it can be concluded that sorghum crop sowing at different dates can minimize the incidence of shoot fly. The information generated in present study reveals that sowing of sorghum in the month of June minimize the incidence of shoot fly and increase production efficiency besides safety to the environment.

Acknowledgements

All sort of assistance rendered by Director of Research, Chaudhary Charan Singh Haryana Agricultural University, Hisar, India for the above study is gratefully acknowledged.

Declarations

Source of Funding

This research did not receive any grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing Interests Statement

The authors declare no competing financial, professional and personal interests.

Ethical Approval

Not applicable.

Consent for publication

Authors declare that they consented for the publication of this research work.

Availability of data and material

Authors are willing to share the data and material according to relevant needs.

References

- Anonymous, (2017). Package of practices of *Kharif* crops. CCS Haryana Agricultural University, Hisar.
- Ameta, O.P. and Sumeria, H.K. (2004). Effect of sowing dates on the incidence of insect pests and productivity of sorghum [(*Sorghum bicolor* (L.) Moench)]. *Indian Journal of Agricultural Research*, 38 (4): 278-282.
- Borad, P.K. and Mittal, V.P. (1983). Assessment of losses caused by pest complex to sorghum hybrid, CSH 5. In: B.H. Krishnamurthy Rao and K.S.R.K. Murthy (Eds.), Crop losses due to insect pests, Special issue of *Indian Journal of Entomology*. pp. 271-278. Entomological Society of India, Rajendranagar, Hyderabad, Andhra Pradesh, India.
- Doggett, H., Starks, K.J. and Eberhart, S.A. 1970. Breeding for resistance to the sorghum shoot fly. *Crop Sci.* 10.
- FAO 2021: <http://www.fao.org/faostat/en/#data> (accessed on 19th of June, 2021).
- Hossain, MA; Prodhan, MZH and Sarker, M.A. 2009. Sowing dates: A major factor on the incidence of major insect pests and yield of mungbean. *Journal of Agriculture Rural Development*. 7(1 & 2): 127-133.
- Jotwani, M.G. 1981. Integrated approach to the control of the sorghum shoot fly. *Insect Science and its Application*. 2:123-127.
- Salman, A.M.A. and Abdel-Moniem, A.S.H. (2008). Effect of planting dates and maize hybrids on the infestation with sorghum shoot fly, *Atherigona soccata* Rondani and its effect on the yield. *Archives of Phytopathology and Plant Protection*. 41(5): 349-359.
- Sathish, R., Manjunatha, M. and Rajash ekarappa, K. 2017. Incidence of shoot fly, *Atherigona pulla* (Wiedemann) on proso millet at different dates of sowing. *Journal of Entomology and Zoology Studies*. 5(5): 2000-2004.
- Satyagopal, K., S.N. Sushil, P. Jeyakumar, G. Shankar, O.P. Sharma, S.K. Sain, D.R. Boina, N. Lavanya, B.S. Sunanda, Ram Asre, R. Murali, Sanjay Arya, Subhash Kumar, H.S. Yadava, S. Lingaraju, R.N. Ganguli, M.P. Thakur, A.S. Kotasthane J.S. Mishra, V.K. Koshta, A.K. Awasthi, H. Ravindra, B.K. Shivanna, S. Gangopadhyay, V.R. Bhagwat, I.K. Das, S.T. Kajjidoni, B.R. Patel, L.V. Ghetiya, N. Sathyanarayana and S. Latha 2014. *AESA based IPM package for Sorghum*, 44pp.
- Seshu, Reddy, K.V. and Davies, J.C. 1979. *Pests of sorghum and pearl millet, and their parasites and predators*, recorded at ICRISAT Center, India, upto August, 1979. Cereal Entomology Progress Report No.2. Patancheru, A.P. 502324, India: International Crop Research Institute for the Semi-Arid Tropics. 23pp.
- Sheoran, O.P., Tonk, D.S., Kaushik, L.S., Hasija, R.C. and Pannu, R.S. (1998). *Statistical software package for agricultural research workers*. Recent advances in information theory, statistics and computer application by Hooda, D.S. and Hasija, R.C., Department of Mathematics and Statistics, CCS HAU, Hisar. 139-143.
- Wiseman, B.R. and Morrison, W.P. (1981). *Components for management of field corn and grain sorghum insects and mites in the United States*. USDA Agricultural Research Service ARMS-18, Government Printing Office, Washington, DC, USA.

Muhammad, R. K., Ying Ying, S., Khan, S., Sana, U. B., Wu, L.L., Lu Yang Yang, T.T., Hu, Z., Salam, A., Iqbal, S., Ali, S. and Bashir, W.(2014). Effect of different sowing dates on insect pest population of chillies (*Capsicum annuum* L). *Journal of Biology, Agriculture and Healthcare*. 4: 196-208.

Pavani T., Ramesh B.T., Sridevi, D., Radhika, K. and Sharma, H.C. (2019). Effect of different sowing dates on pest incidence in chickpea. *International Journal of Current Microbiology and Applied Sciences*. 8: 627-637.

Ullah, F., S. Anwar, H. Badshah, M. A. Mashwani and M. H. Khan. 2010. Effect of different planting dates of maize on infestation of maize stem borer, *Chilo partellus* (swinhoe) pyralidae: Lepidoptera. *Sarhad Journal of Agriculture*. 26(4): 621-624.