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SCREENING OF PEARL MILLET GENOTYPES FOR RESISTANCE TO SHOOT FLY *ATHERIGONA APPROXIMATA* MALLOCH AND EAR HEAD WORM *HELICOVERPA ARMIGERA* (HUBNER)

Pooja Kumari[1], Shalini Pandey[1]* and Vikas Khandelwal[2]

[1]Agricultural Research Station, Mandor, Agriculture University, Jodhpur 342304, Rajasthan, India
[2]ICAR-AICRP on Pearl Millet, Agriculture University, Jodhpur 342304, Rajasthan, India
*Email: pandeyshalini80@gmail.com (corresponding author): ORCID ID 0000-0003-0985-3731

ABSTRACT

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is the sixth most important cereal crop and widely grown on 30 million ha in the arid and semi-arid tropical regions of Asia and Africa. Shoot fly, *Atherigona approximata* Malloch and ear head worm *Helicoverpa armigera* Hubner are the key pests of pearl millet and can reduce yield up to 15-20 and 36.67%, respectively. The present study was planned to evaluate 31 promising genotypes for resistance to *A. approximata* and *H. armigera*. GHB-744 and HHB-67 were found free from *A. approximata* infestation while the Raj-171 (3.13%), GHB-732 (3.71%), AHB-1200 (4.30%), GHB-905 (4.41%), Kaveri Super Boss (4.44%) and MPMH-21 (4.81%) were found moderately resistant to *A approximata* at 28 days after germination. Likewise, AHB-1200 (1.33 larvae/ 5 ear heads) followed by GHB-732 (1.67 larvae/ 5 ear heads) and GHB-905 (2.00 larvae/ 5 ear heads) were found moderately resistant to *H. armigera*.

Key words: *Pennisetum glaucum*, host plant resistance, *Atherigona approximata*, *Helicoverpa armigera*, GHB-744, HHB-67, Raj-171, GHB-732, AHB-1200, GHB-905, Kaveri Super Boss, MPMH-21

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is one of the most important millet crop in India (Satyavathi et al., 2021) and is usually grown under the most adverse agroclimatic conditions (Rai et al., 2008). It is commonly used for food and fodder purpose in the rainfed regions of the country (Srivastava et al., 2020). Quality and yield of such an important crop is reduced by various abiotic and biotic factors. Among them, the losses caused by insect pests are the major constraints. Shoot fly *Atherigona approximata* Malloch and ear head worm *Helicoverpa armigera* (Hubner) are the major insect pests (Juneja et al., 2022). *H. armigera* and *A. approximata* cause damage up to 15-20 and 36.67%, respectively (Dabhi, 2020; Rawat et al., 2021). Many attempts are being made to control these insect pests using insecticides. It is practically impossible to take up spraying in the later stages. Insecticides are moreover costly, which is not accessible for marginal farmers and also involves greater risk of pesticides hazards (Radadiya et al., 2022). Realizing various negative environmental impacts, researchers all over the world are diverting their attention to develop safer and sustainable methods. Host plant resistance can be used as a principal component of IPM and plays an important role in crop protection, as it is ecofriendly and compatible with other methods (Jatav et al., 2017; Sharma et al., 2020). Identification of sources of resistance is important for the introgression of resistance genes into cultivars through breeding. The identification of new insect resistance sources provides breeders with avenues to breed for resistance (Nair et al., 2019). Therefore, the present study was conducted to screen genotypes to major insect pests of pearl millet.

MATERIALS AND METHODS

The experiment was conducted to evaluate genotypes of pearl millet for resistance to *A. approximata* and *H. armigera* at the Research Farm, Agricultural Research Station, Mandor, Jodhpur. Thirty one genotypes of pearl millet procured from Project Coordinating Unit, AICRP on Pearl millet, Jodhpur were evaluated for resistance. The experiment was laid out in RBD (randomized block design) with three replications in kharif 2022. The seeds were sown in first fortnight of July and each genotype was sown in single row length of 4 m with 50 cm and 15 cm between rows and plants, respectively. The observations of shoot fly damage was recorded 28 days after germination (DAG) by counting the number of damaged plants out of total plants from each genotype and thus percent damage at vegetative stage was worked out. At ear head stage, ear head worm was also counted from 5 ear heads from each genotype. Categorization of genotypes on the basis of shoot fly damage and

larval incidence of ear head worm (Pateliya, 2019; Anonymous, 2022).

RESULTS AND DISCUSSION

Host-plant resistance is the most practical approach to pest management for millets, grown in marginal soil with minimal inputs (Prasad and Babu, 2016). It has the main benefit of requiring almost little input from the farmer, other than seed. The most crucial thing to do is to identify the sources of resistance to the main pests of millets and this will help breeders to create resistant hybrids and varieties (Kishore, 1995). The results of the present study indicated that *A. approximata* infestation started from the last week of July. Two genotypes viz. GHB-744 and HHB-67 were categorized as resistant while six genotypes viz., the Raj-171 (3.13%), GHB-732 (3.71%), AHB-1200 (4.30%), GHB-905 (4.41%), Kaveri Super Boss (4.44%) and MPMH-21 (4.81%) were recorded as moderately resistant to *A. approximata* (Table 1). Maximum infestation was recorded in genotypes viz., Dhanshakti (16.31%) followed by Proagro-9444 (15.39%), GHB-538 (15.00%), MP-7792 (14.91%), Pusa Composite 383 (14.72%), GHB-558 (14.40%), ICMV-221 (13.83%), RHB-233 (13.80%), GHB-719 (13.60%), PB-1705 (13.40%), MPMH-17 (13.31%), RHB-173 (12.96%), MP-7878 (12.94%) and AHB-1269 (10.90%) and categorized susceptible to *A. approximata* (Table 1). Similarly, Patange et al. (2017) reported that the maximum shoot fly infestation was observed in variety Dhanshakti (0.24 maggots/ plant) and the minimum shoot fly infestation was recorded in AHB-1200 (0.09 maggots/ plant) of pearl millet. Choudhary (2017) reported that the genotypes viz. 86M86, GHB 732, ICMV 221, RHB 173 and GHB 744 were recorded 5.1-10.0% damage while GHB 558, RAJ 171 and HHB 67 were recorded 10.1-20.0% damage to shoot fly in pearl millet. Oviposition antixenosis and antibiosis are the main mechanisms of shoot fly resistance (Dhillon et al., 2005; Riyazaddin et al., 2015; Gorthy et al., 2017; Salama et al., 2020).

Table 1. Reaction of pearl millet genotypes to *A. approximata* and *H. armigera* under field conditions

S. No.	Genotype	*A. approximata* dead heart (%)	*H. armigera*/ 5 ear heads	S. No.	Genotype	*A. approximata* dead heart (%)	*H. armigera*/ 5 ear heads
1	RHB-173	12.96	4.67	17	PB-1852	9.38	11.00
2	RHB-223	7.82	5.00	18	Kaveri Super Boss	4.44	12.33
3	RHB-233	13.80	13.33	19	MP-7792	14.91	10.33
4	RHB-234	7.01	7.00	20	MP-7878	12.94	14.33
5	MPMH-17	13.31	11.33	21	AHB-1200	4.30	1.33
6	MPMH-21	4.81	12.67	22	AHB-1269	10.90	8.00
7	GHB-538	15.00	4.67	23	Proagro-9444	15.39	10.33
8	GHB-558	14.40	9.33	24	86M86	5.64	13.67
9	GHB-719	13.60	10.33	25	KBH-108	8.05	4.33
10	GHB-732	3.71	1.67	26	Raj-171	3.13	2.67
11	GHB-744	0.00	3.67	27	Pusa Composite 383	14.72	11.00
12	GHB-905	4.41	2.00	28	Pusa Composite 701	6.95	9.67
13	HHB-67	0.00	13.33	29	JBV-2	8.42	5.00
14	HHB-299	8.85	11.00	30	ICMV-221	13.83	11.33
15	PB-1705	13.40	8.00	31	Dhanshakti	16.31	14.33
16	PB-1756	8.74	13.67				

Resistance categories

S. No.	On the basis of *A. approximata* infestation			On the basis of larval population of *H. armigera*		
	Range of infestation	Resistance category	Number of entries	Range of larval population/ 5 ear heads	Resistance category	Number of entries
1	0.0%	Free from infestation	2	0.0	Free from infestation	0
2	0.1 to 5.0%	Moderate Resistant	6	0.1-2.0	Moderate Resistant	3
3	5.1 to 10.00%	Tolerant	9	2.1-5.0	Tolerant	7
4	10.1-20.00	Susceptible	14	Above 5.0	Susceptible	21
5	Above 20.00	Highly Susceptible	0			

Physico-chemical traits such as leaf glossiness, trichome density, and plumule and leaf sheath pigmentation were found to be associated with resistance, and chlorophyll content, leaf surface wetness, seedling vigor, and waxy bloom with susceptibility to shoot fly in sorghum (Dhillon et al., 2005; Kalpande et al., 2015; Salama et al., 2020). Synchronized tillering after the main shoot is killed is potentially a form of recovery resistance, since some genotypes tillers exhibit higher resistance levels than the main shoots (Dogget, 1972). The infestation of *H. armigera* was observed at ear head stage of pearl millet under field conditions. Three genotypes viz. AHB-1200 (1.33 larvae/ 5 ear heads) followed by GHB-732 (1.67 larvae/ 5 ear heads) and GHB-905 (2.00 larvae/ 5 ear heads) were categorized as moderately resistant (0.1-2.0 larvae/ 5 ear heads) while seven genotypes viz. Raj-171 (2.67 larvae/ 5 ear heads), GHB-744 (3.67 larvae/ 5 ear heads), KBH-108 (4.33 larvae/ 5 ear heads), RHB-173 and GHB-538 (4.67 larvae/ 5 ear heads), RHB-223 and JBV-2 (5.00 larvae/ 5 ear heads) were categorized as tolerant (2.1-5.0 larvae/ 5 ear heads) to *H. armigera* in pearl millet (Table 1). Twenty one genotypes were categorized as susceptible (>5 larvae/ 5 ear heads) to *H. armigera* in pearl millet. Similarly, Pateliya (2019) reported that the minimum larval population of *H. armigera* (< 5.0 larvae/ 5 ear heads) was recorded in hybrids viz. GHB-538, GHB-744 and GHB-905 and maximum larval population (>5 larvae/ 5 ear heads) was recorded in hybrid GHB-558 of pearl millet. Patange et al. (2017) reported that the hybrid AHB-1200 (0.13 larvae/ plant) was found resistant to *H. armigera* while the variety Dhanshakti (0.29 larvae/ plant) was found susceptible to *H. armigera* in pearl millet. Many lepidopterous larvae infest the ear head of finger millet and the variety, the season, and other factors all have a significant impact on the total damage. According to Murthi and Harinarayana (1989) and Sharma et al. (1988), compact or tight-fisted panicles are more vulnerable to attack as these panicles provide a favourable microclimate that allows worms to grow or hide inside the closed head. The present study concluded that the moderately resistant varieties/hybrids identified in the investigation may grow in endemic areas, hot spots, or to lessen the location- specific pest problems in the pearl millet cultivation.

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AUTHOR CONTRIBUTION STATEMENT

PK: Conducted research, written manuscript; SP: Conceptualized, planned and guided during the study and corrected manuscript; VK: Provided the study material as well as technical guidance.

CONFLICT OF INTEREST

No conflict of interest.

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