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EVALUATION OF PEARL MILLET VARIETIES / GENOTYPES FOR THEIR RESISTANCE AGAINST *HELICOVERPA ARMIGERA* (HUBNER)

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ABSTRACT

A field experiment was conducted at Instructional farm, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat during *Kharif*, 2024 to screen different pearl millet varieties/genotypes against *Helicoverpa armigera* (Hubner). Field screening of ten different varieties/genotypes of pearl millet was carried out for their resistance against *H. armigera* based on larval infestation and earhead damage revealed that none of the varieties/genotypes were found highly resistance (HR) or highly susceptible (HS). But, variety/genotype GHB-1225 found resistant against *H. armigera* as it recorded the lowest (1.60/5 earhead and 2.41/20 earhead) larval population and damaged earhead, respectively. While, GHB-1231, J 2340 and GHB-1129 varieties/genotypes discovered as moderately resistant (MR). However, GHB-744, GHB-1294, GHB-732 and ICMB 99222 were found to be moderately susceptible (MS) for their resistance against pest population. But, varieties/genotypes GHB-538 and ICMB-95444 recorded higher 5.86 and 6.24 larvae/5 earhead, respectively as well as higher 7.40 and 7.74 damaged earhead/20 earhead, respectively. Thus, GHB-538 and ICMB-95444 categorized under susceptible varieties/genotypes against *H. armigera*.

Introduction

Pearl millet is one of the four most important cereals (rice, maize, sorghum and millet) grown in tropical semi-arid regions of the world primarily in Africa and Asia (Nambiar *et al.,* 2011). Pearl millet [*Pennisetum glaucum* (L.) R. Br] belongs to the family Poaceae. It is also known as Bajri (Gujarati and Marathi), Bajra (Hindi), Sajje (Kannada), Kambu (Tamil), Sajjalu (Telugu) in India (Keerthana *et al.,* 2021). Because of its tolerance to difficult growing conditions such as drought, low soil fertility and high temperature, it can be grown in areas where other cereal crops, such as maize or wheat would not survive (Basavaraj *et al.,* 2010). The nutritive value of pearl millet is fairly higher with carbohydrates (67%), Fat (5%), marginal protein (11.6%) and minerals (2.7%). It is rich in vitamin A and B. Besides that, seed also contain minerals like calcium, potassium, iron, zinc and magnesium (Khairwal *et al.,* 2007). It is usually grown under the most adverse agro-climatic conditions where other crops like sorghum and maize fail to produce economic yields. In India, during 2023-24 about total 7.38 million ha area was covered under pearl millet with total production of 10.72 million tonnes. Uttar Pradesh, Haryana, Gujarat, Madhya Pradesh, Maharashtra and Karnataka are leading states in pearl millet production (Anon., 2024a). The major districts growing this crop include Banaskantha, Anand, Kheda, Bhavnagar, Kachchh and Mehsana (Anon., 2024b). Due to low yield potential as well as fluctuating grain prices plant protection measures were hardly taken. However, potentially very high-yielding hybrid varieties attract a heavy incidence of pearl

millet insect pests. It is important to screen different varieties/cultivars to check for resistance against insect pests under optimum levels of infestation and similar environmental conditions. However, there is a need to develop cultivars with multiple resistances to insect pests and diseases that will be in greater demand in the future for sustainable crop production and this requires a concerted effort from scientists involved in crop improvement programs worldwide.

Materials and Methods

Ten different pearl millet varieties/genotypes *viz.*,GHB-1294, GHB-538, GHB-1129, GHB-1225, GHB-1231, GHB-744, J 2340, ICMB 95444, ICMB 99222 and GHB-732 were sown during the second week of September, 2024 in area of 4.0 m × 2.4 m and 3.0 m × 1.2 m gross and net plot size, respectively with the spacing of 60 cm × 10 cm between rows and plant in Randomized Block Design (RBD) replicated three times at Instructional farm, College of Agriculture, Junagadh Agricultural University, Junagadh. The observation on *H. armigera* population was recorded on five randomly selected plants to count the larval population and on twenty plants for earhead damage. Yield was recorded after harvesting and threshing of the crop. Thus, the data obtained was subjected to statistical analysis for assessing the resistance and susceptibility of the pearl millet varieties/genotypes against *H. armigera*.

Categorization of different varieties/genotypes

To differentiate the *H. armigera* infestation on ten different varieties/genotypes, an attempt was made to splinter the varieties/genotypes into different categories. Patel *et al*. (2002) has categorized the castor varieties/genotypes into four groups *viz*., highly resistant, resistant, susceptible and highly susceptible. With the help of this statistical tool, the categorization of pearl millet varieties/genotypes were further grouped into six categories of resistance to *H. armigera viz*., Highly resistant (HR), Resistant (R), Moderately resistant (MR), Moderately susceptible (MS), Susceptible (S) and highly susceptible (HS) based on pest population and earhead damage. For categorization, the mean value of individual genotype $(\overline{X}_i)$ was compared with the mean value of all genotypes $(\overline{X})$ and standard deviation (SD). The scale used for categorizing different genotypes/varieties is as under:

Category of resistance	Scale for resistance
Highly resistant	$\overline{X}\, i \leq (\overline{X} - 2SD)$
Resistant	$(\overline{X} - SD) \geq \overline{X}\, i > (\overline{X} - 2SD)$
Moderately resistant	$\overline{X} \geq \overline{X}\, i > (\overline{X} - SD)$
Moderately susceptible	$\overline{X} < \overline{X}\, i \leq (\overline{X} + SD)$
Susceptible	$(\overline{X} + SD) < \overline{X}\, i \leq (\overline{X} + 2SD)$
Highly susceptible	$\overline{X}\, i > (\overline{X} + 2SD)$

Results and Discussion

Larval population

The data on screening of varieties/genotypes based on results of pooled over period presented in Table 1 and depicted in Fig 1 showed that the chronological order of various varieties/genotypes in comparison to GHB-1225 (1.60 larvae/5 earheads) recorded the lowest infestation, based on number of larvae/5 earhead given in bracket was: GHB-1231 (2.95) < J 2340 (3.27) < GHB-1129 (3.68) < GHB-744 (4.50) < GHB-1294 (4.74) < GHB-732 (5.05) < ICMB-99222 (5.44) < GHB-538 (5.86) < ICMB-95444 (6.24). It can be concluded that the lowest (1.60 larvae/5 earheads) larval population was recorded in GHB-1225 and the highest (6.24 larvae/5 earheads) larval population was recorded in ICMB 95444 variety/ genotype of pearl millet.

Damaged earhead

In case of damaged earhead infested by *H. armigera*, based on results of pooled over period presented in Table 1 and depicted in Fig 2 showed that the chronological order of various varieties/genotypes in comparison to GHB-1225 recorded the lowest (2.41/20 earheads) number of damaged earhead, based on number of damaged earheads/20 earheads given in bracket was: GHB-1231 (4.07) < J 2340 (4.64) < GHB-1129 (4.98) < GHB-1294 (5.69) < GHB744 (6.05) < GHB-732 (6.32) < ICMB-99222 (6.68) < GHB-538 (7.40) < ICMB95444 (7.74). From the above findings we can revealed that the lowest (2.41 damaged

earhead/20 earhead) earhead damage was found in GHB-1225 and the highest (7.74 damaged earheads/20 earheads) earhead damage was found in ICMB-95444 variety/genotype of pearl millet.

The present findings on varietal screening were strongly in accordance with results of Patange *et al.* (2017), as he stated that the line *viz.*, ICMH 98222 B (0.34 larva/plant) was found to be most susceptible to *H. armigera* followed by Dhanshakti (0.29 larva/plant), ICMH 98222 A (0.28 larva/plant) recorded moderate population. According to Anon. (2022) the larval population in the hybrids recorded as in GHB-1294 (0.5 larva/5 earhead), GHB-744 (1.0 larva/5 earheads), GHB-538 (1.0 larva/5 earheads), GHB-558 (0.0 larva/5 earheads), GHB-1129 (0.0 larva/5 earheads), GHB-1225 (0.0 larva/5 earheads), GHB-1231 (0.5 larvae/5 earhead), GHB-732 (0.5 larva/5 earheads) and Dhanshakti (0.5 larva/5 earheads). Anon. (2023a) stated that the incidence of larval population in the hybrids was recorded as GHB-1294 (1.5 larvae/5 earheads), GHB-538 (5.5 larvae/5 earheads), GHB-1129 (3.0 larvae/5 earheads), GHB1225 (5.5 larvae/5 earheads), GHB-1231 (1.0 larva/5 earheads) and Dhanshakti (2.0 larvae/5 earheads).

Table 1: Relative susceptibility of different varieties/genotypes of pearl millet against *H. armigera* during *Kharif*, 2024 (based on pooled over period)

No.	Name of varieties/Genotypes	No. of larvae/5 earhead	No. of damaged earhead	Yield (kg/ha)
1.	GHB-1294	2.18^{d} (4.74)	2.39^{de} (5.69)	1517^{d}
2.	GHB-538	2.42^{fg} (5.86)	2.72^{gh} (7.40)	855^{e}
3.	GHB-1129	1.92^{c} (3.68)	2.23^{cd} (4.98)	2197^{b}
4.	GHB-1225	1.26^{a} (1.60)	1.55^{a} (2.41)	2732^{a}
5.	GHB-1231	1.72^{b} (2.95)	2.02^{b} (4.07)	2238^{b}
6.	GHB-744	2.12^{d} (4.50)	2.46^{ef} (6.05)	1747^{cd}
7.	J 2340	1.81^{bc} (3.27)	2.15^{bc} (4.64)	1990^{bc}
8.	ICMB 95444	2.50^{g} (6.24)	2.78^{h} (7.74)	722^{e}
9.	ICMB 99222	2.33^{ef} (5.44)	2.59^{fg} (6.68)	931^{e}
10.	GHB-732	2.25^{de} (5.05)	2.52^{ef} (6.32)	1533^{d}
	S. Em. ±	**0.05**	**0.06**	**112.87**
	C.D. at 5%	**0.13**	**0.16**	**335.34**
	C. V. (%)	**8.85**	**9.48**	**11.88**

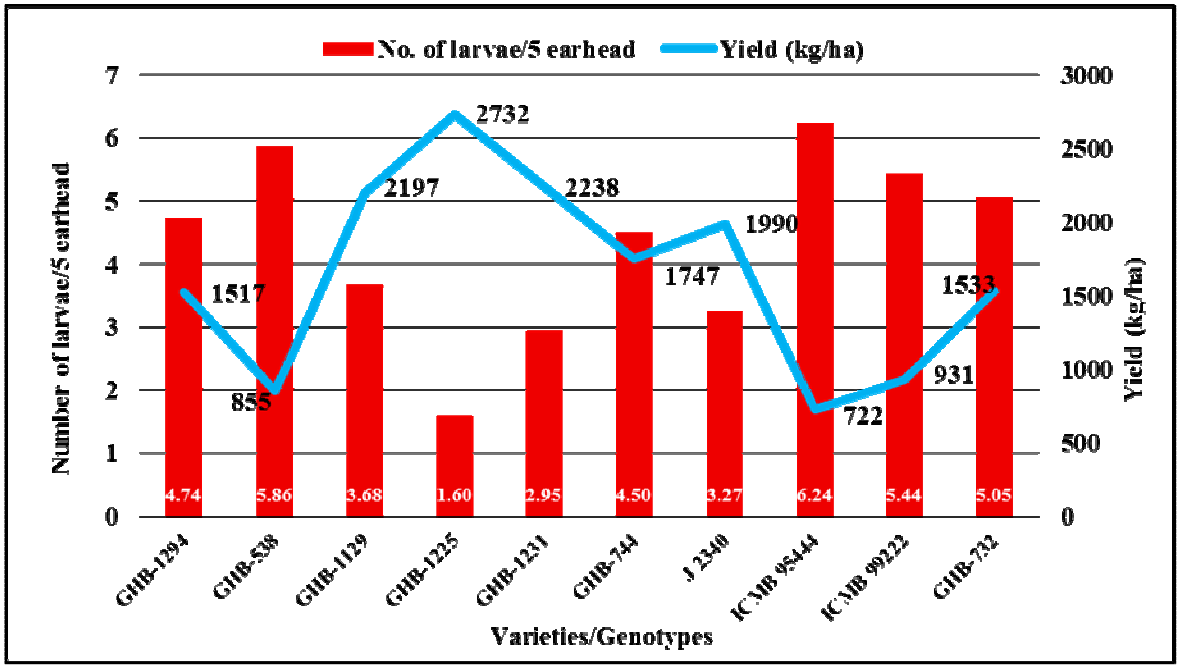

Fig. 1: Effect of pearl millet varieties/genotypes on infestation of *H. armigera* and yield

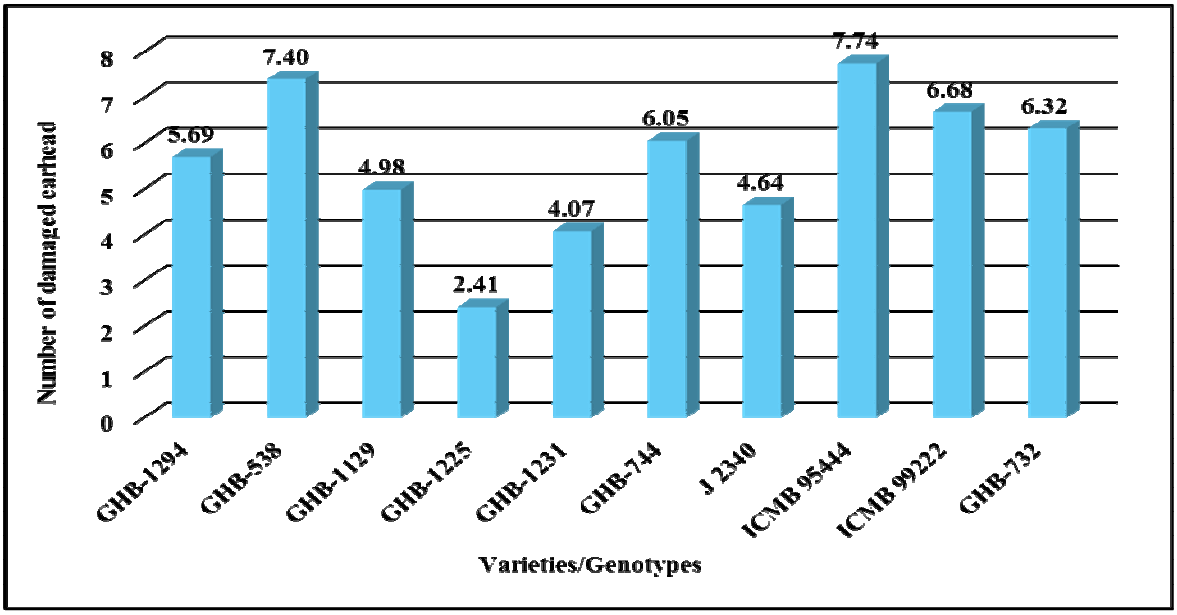

Fig. 2: Earhead damage due to *H. armigera* on different varieties/genotypes of pearl millet

Categorization on the basis of larval population of *H. armigera*

The categorization based on larval infestation (Table 2) revealed that none of the screened varieties/genotypes were found highly resistant (HR) and highly susceptible (HS) against H. armigera. But, GHB-1225 was found to be resistant (R) among screened varieties/genotypes. However, GHB-1231, J 2340 and GHB-1129 were found to be moderately resistant (MR). While, GHB-744, GHB-1294, GHB-732 and ICMB-99222 were found moderately susceptible (MS). But, GHB-538 and ICMB-955444 were discovered as susceptible (S) varieties/genotypes against *H. armigera.*

Table 2: Categorization of pearl millet varieties/genotypes for their susceptibility to *H. armigera* based on number of larvae/5 earhead

Category of resistance	Scale	Varieties/genotypes
	$\overline{X}$ = 4.33	SD = 1.45
Highly resistant	$\overline{X}$ i ≤ 1.44	-
Resistant	2.88 ≥ $\overline{X}$ i> 1.44	GHB-1225 (1.60*)
Moderately resistant	4.33 ≥ $\overline{X}$ i> 2.88	GHB-1231 (2.95), J 2340 (3.27) and GHB-1129 (3.68)
Moderately susceptible	4.33 < $\overline{X}$ i ≤ 5.78	GHB-744 (4.50), GHB-1294 (4.74), GHB-732 (5.05) and ICMB 99222 (5.44)
Susceptible	5.78 < $\overline{X}$ i ≤ 7.23	GHB-538 (5.86) and ICMB 95444 (6.24)
Highly susceptible	$\overline{X}$ i> 7.23	-

Note: $\overline{X}$ = Mean value of all varieties/genotypes
$\overline{X}$ i = Mean value of individual varieties/genotypes
* Figure in the parenthesis are number of larvae/5 earhead
SD = Standard deviation

Categorization on the basis of number of earhead damage by *H. armigera*

Also, categorization based on earhead damage by *H. armigera* (Table 3) noted that none of the screened varieties/genotypes were found highly resistant (HR) and highly susceptible (HS). But, GHB-1225 categorized as resistant (R) among screened varieties/genotypes. However, GHB-1231, J 2340 and GHB-1129 were found to be moderately resistant (MR) varieties/genotypes. While, GHB-1294, GHB-744, GHB-732 and ICMB-99222 were discovered as moderately susceptible (MS) varieties/genotypes. But, GHB-538 and ICMB-955444 were discovered as susceptible (S) varieties/genotypes against damage of *H. armigera.*

Table 3: Categorization of pearl millet varieties/genotypes for their susceptibility to *H. armigera* based on number of damaged earhead

Category of resistance	Scale	Varieties/genotypes
	$\overline{X}$ = 5.60	SD = 1.62
Highly resistant	$\overline{X}$ i ≤ 2.36	-
Resistant	3.98 ≥ $\overline{X}$ i> 2.36	GHB-1225 (2.41**)
Moderately resistant	5.60 ≥ $\overline{X}$ i> 3.98	GHB-1231 (4.07), J 2340 (4.64) and GHB-1129 (4.98)
Moderately susceptible	5.60 < $\overline{X}$ i ≤ 7.22	GHB-1294 (5.69), GHB-744 (6.05), GHB-732 (6.32) and ICMB 99222 (6.68)
Susceptible	7.22 < $\overline{X}$ i ≤ 8.84	GHB-538 (7.40) and ICMB 95444 (7.74)
Highly susceptible	$\overline{X}$ i> 8.84	-

Note: $\overline{X}$ = Mean value of all varieties/genotypes
$\overline{X}$ i = Mean value of individual varieties/genotypes
** Figure in the parenthesis are number of damaged earhead
SD = Standard deviation

Conclusion

From the forgoing discussion, it could be concluded that variety/genotype GHB-1225 found resistant against *H. armigera* as it recorded the lowest (1.60/5 earhead and 2.41/20 earhead) larval population and damaged earhead, respectively. While, GHB-1231, J 2340 and GHB-1129 varieties/genotypes discovered as moderately resistant (MR). However, GHB-744, GHB-1294, GHB-732 and ICMB 99222 were found to be moderately susceptible (MS) for their resistance against pest population. But, varieties/genotypes GHB-538 and ICMB-95444 recorded higher 5.86 and 6.24 larvae/5 earhead, respectively as well as higher 7.40 and 7.74 damaged earhead/20 earhead, respectively. Thus, GHB-538 and ICMB-95444 categorized under susceptible varieties/genotypes against *H. armigera*. Among all screened varieties/genotypes, the highest yield (2732 kg/ha) was recorded from GHB-1225 than the rest of the varieties/genotypes followed by GHB-1231 (2238 kg/ha) and GHB-1129 (2197 kg/ha).

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