

## RESISTANCE IN PEARL MILLET GERMPLASM TO GREENBUG, *SCHIZAPHIS GRAMINUM* (RONDANI)

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**ABSTRACT:-** The status of host-plant resistance was evaluated in pearl millet (*Pennisetum glaucum* L.) against aphid species greenbug, *Schizaphis graminum* (Rondani). It was determined by the ability of seedlings to resist for plant stunting caused by aphid's feeding at seedling stage. The results indicated that out of 135 pearl millet entries tested, 21 were resistant, 69 were moderately resistant and 45 were susceptible to greenbug feeding. The resistant entries were: C-591, Pak-75211, Pak-75212, Pak-75219, Pak-75194, Pak-75227, Pak-75238 Pak-75272, Pak-75276, WCA-78, C-47, Pak-75322, Pak-75323, Pak-75329, Pak-75331, Pak-75334, Pak-75337, Pak-75338, Pak-75339, Pak-75353 and Pak-75359. The entries resistant or moderately resistant with damage rating < 4 in the present studies may be used in any breeding programme to reduce greenbug damage, whereas the susceptible entries should be avoided.

*Key Words:* Pearl Millet, Germplasm Screening, Resistance; Greenbug; *Schizaphis graminum*; Pakistan.

### INTRODUCTION

Pakistan is one of those countries, which are mainly dependent on agriculture (Akhtar et al., 2011). To meet the food requirements of such a huge population it is imperative to make candid efforts to enhance agricultural production (Akhtar et al., 2006). Aphids are the most familiar insect pests commonly known as green fly or black fly, which are major pests of field crops. Aphids occur mainly as winter pest in the world (Akhtar et al., 2010) and can survive throughout the year. Rabbinge et al. (1983) reported that the most important factors for yield losses of all crops were powdery mildew and cereal aphids. Aphid

population has been increasing for the last few years on wheat crop and has attained the status of pest in Pakistan (Aheer et al., 1994 and Zia et al., 1999).

*Schizaphis graminum* (Rondani) Homoptera: Aphididae is a prominent aphid species present in Pakistan (Rustamani et al., 1999). About 96 graminaceous plants are attacked by this aphid (Petersson, 1971). Damage is caused by extraction of plant sap, injection of toxic secretions while feeding and transmission of viral diseases such as barley yellow dwarf virus.

The use of greenbug resistant varieties is an effective control measure. Since the recognition of the greenbug as a damaging pest,

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resistant varieties of both small grains and sorghum have been released (Kannan, 1999). The incidence of aphids has been reported to be significantly different on different cultivars of pearl millet (Akhtar et al., 1991), because their pre-reproductive, reproductive and post-reproductive periods and fecundity are significantly affected by crop varieties. The present work was conducted to screen some pearl millet varieties/ lines for resistance against the aphid, *Schizaphis graminum*.

## MATERIALS AND METHOD

The greenbugs, attacking on wheat, were collected from Char-sadda (Khyber Pakhtunkhwa). One hundred and thirty five pearl millet entries were collected from Plant Genetic Resources Programme, National Agricultural Research Centre, Islamabad (Table 1).

About 20 seeds of susceptible wheat cultivar Faisalabad-83 were sown in a plastic pot (11.5 cm diameter, 11 cm high). The pots were kept in a rearing cage measuring 112 cm x 50 cm x 62 cm. Left, right and rear sides of the cage were covered with muslin cloth to facilitate aeration. On the front side, doors were provided for manipulation and transparent plastic was used to facilitate visibility. To provide adequate light the fluorescent tubes were provided at the top of the cage. In each cage two bulbs (50 W) were provided for yellow light. The temperature in the rearing room was maintained at  $27\pm 3^{\circ}\text{C}$  and the relative humidity was  $60 \pm 5\%$ . The photophase was 16h: 8h day:night.

## Seedling Bulk Test and Assessment of Resistance

When the seedlings were about 15 cm high the plants were infested with the greenbug. One row of each test entry was sown in standard soil mix in a metal tray (51 cm x 35 cm x 9 cm). There were 9 rows in a tray and about 20 seedlings of an entry or line in a row. The position of an entry in a row was determined at random. When the seedlings were 5 cm high, 10 greenbugs per seedling were released on them. The plants were observed daily and if the infestation level declined, more greenbugs were added.

To assess the resistance in pearl millet entries, two visual observations were made. First visual observation was made 10 days after aphid infestation, and the pots with dead plants were replaced with those having fresh healthy plants. The greenbugs automatically shifted from the dying plants to the healthy plants. The second visual observation was made after 10 days of first observation. On the basis of visual observations, Damage Rating scale of 0-9, where 0=healthy and 9= dead was applied to categorize the plants as resistant (damage rating < 3), moderately resistant (damage rating 4-6) or susceptible (damage rating 7-9), following Webster and Inayatullah (1988) and Akhtar et al. (2011).

## RESULTS AND DISCUSSION

The results indicated that out of 135 pearl millet entries tested, 21 were resistant, (DR= 0-3), 69 were moderately resistant (DR= 4-6) and 45 were susceptible to greenbug (DR= 7-9) (Table 1).

**Table 1. Pearl millet entries with different level of resistance against greenbug**

Resistant		Moderately resistant				Susceptible	
DR = 2	DR = 3	DR = 4	DR = 5	DR = 6	DR = 7	DR = 8	DR = 9
C-591	Pak-75211	Pak-75177	Pak-75176	Pak-75175	Pak-75189	Pak-75191	Pak-75186
	Pak-75212	Pak-75182	Pak-75178	Pak-75181	Pak-75198	Pak-75190	Pak-75195
	Pak-75219	Pak-75183	Pak-75193	Pak-75184	Pak-75221	Pak-75199	Pak-75196
	Pak-75194	Pak-75203	Pak-75197	Pak-75185	Pak-75277	Pak-75222	Pak-75204
	Pak-75227	Pak-75206	Pak-75201	Pak-75184	Pak-75279	Pak-75229	Pak-75205
	Pak-75238	Pak-75213	Pak-75224	Pak-75185	Pak-75281	Pak-75232	Pak-75206
	Pak-75272	Pak-75214	Pak-75235	Pak-75186	ICMS-7703	Pak-75239	Pak-75207
	Pak-75276	Pak-75230	Pak-75270	Pak-75187	Pak 75315	Pak 75346	Pak-75208
	WCA-78	Pak-75278	Pak-75273	Pak-75188	Pak 75317		Pak-75209
	C-47	Pak-75284	Pak-75282	Pak-75192	Pak 75318		Pak-75218
	Pak-75322	C-8206	Pak-75288	Pak-75200	Pak 75344		Pak-75231
	Pak-75323	WC-C-75	Pak-75316	Pak-75220	Pak 75348		Pak-75233
	Pak-75329	Pak-75319	Pak75320	Pak-75225	Pak 75357		Pak-75234
	Pak-75331	Pak-75328	Pak 75327	Pak-75235	Pak 75358		Pak-75236
	Pak-75334	Pak-75333	Pak 75330	Pak-75269	Pak 75362		Pak-75237
	Pak-75337	Pak-75343	Pak-75340	Pak-75280			Pak-75335
	Pak-75338	Pak-75352	Pak- 75349	Pak-75283			Pak-75336
	Pak-75339	Pak-75365	Pak- 75355	Pak-75285			Pak-75341
	Pak-75353	Pak-75367	Pak- 75357	IVC-P-78			Pak-75345
	Pak-75359		Pak-75361	Pak 75313			Pak-75360
			Pak-75363	Pak-75314			Pak-75364
				Pak-75321			
				Pak-75325			
				Pak-75326			
				Pak-75332			
				Pak-5342			
				Pak-75347			
				Pak-75350			
				Pak-75354			
				Pak 75356			
				Pak 75368			

**Entries with DR= 0-3**

Out of all tested entries, only C-591 was found to be resistant. Twenty entries were resistant with DR=3 namely Pak-75211, Pak-75212, Pak-75219, Pak-75194, Pak-75227, Pak-75238, Pak-75272, Pak-75276, WAC-78, C-47, Pak-75322, Pak-75323, Pak-75329, Pak-75331, Pak-75334, Pak-75337, Pak- 75338, Pak-75339, Pak-75353 and Pak-75359.

**Entries with DR= 4-6**

Moderately resistant entries (19) with damage rating of 4 were Pak-75177, Pak-75182, Pak- 75183, Pak-75203, Pak-75206, Pak-75213, Pak-75214, Pak 75230, Pak-75278,

Pak-75284, IC-8206, WC-C-75, Pak-75319, Pak-75328, Pak-75333, Pak-75343, Pak-75352, Pak -5365 and Pak-75367.

**Entries with DR= 7-9**

Susceptible entries with damage rating of 9 were 21 namely Pak-75186, Pak-75195, Pak-75196, Pak-75204, Pak-75205, Pak-75206, Pak-75207, Pak-75208, Pak-5209, Pak-75218, Pak-75231, Pak-75233, Pak-75234, Pak-75236, Pak-75237, Pak-75335, Pak-75336, Pak-75341, Pak-75345, Pak-75360 and Pak-75364.

Biological factors contribute towards the variation of aphid population densities (Naeem et al., 2005; 2002; Hamid, 1976; 1983),

and different varieties/genotypes of a cereal crops show different level of resistance to cereal aphids. Rustamani et al. (1999) observed the varietal response of wheat towards aphid infestation and reported that the cultivar Sarsabaz was resistant, while Mehran-89 was susceptible to *Schizaphis graminum*. Sabater (2006) reported that yield loss is difficult to evaluate, as it is dependent on species and crop. For example, aphid infestation may lead upto loss 30% in wheat, whereas in barley this loss is up to 50%. These previous studies provide rational basis to screen different pearl millet varieties/genotypes for their resistance to cereal aphid infestation. Moreover, three important aphid species have been recorded on cereal crops including *Rhopalosiphum padi*, *R. maidis* and *Schizaphis graminum* (Kannan, 1999). Among these, *S. graminum* is the most abundant and important species, whose occurrence interferes with cereal grain formation and filling. Current study indicated that different pearl millet varieties/lines differ in susceptibility to *S. graminum*. These results are in agreement with those previous studies, which revealed that varieties/genotypes of a cereal crops show different level of resistance to cereal aphids. However, this study doesn't indicate the mechanism of resistance in a cultivar, which needs further investigation.

Previous studies indicate that aphid infestation reduces crop yield (Sekhar and Singh, 1999), by feeding on fruits, leaves, stalks and ears, or by transmitting viruses and fungal diseases (Trdan and Milevoj, 1999). Being sucking insect pest, aphids

prefer to insert their stylets at soft surface with maximum food supply (Ahmad and Aslam, 2000). This study revealed that the greater aphid densities were present on leaves and spikes. These results are in agreement with those of Ahmad and Aslam (2000). The soft nature of leaves and maximum food supply towards terminal portion of the plant might be the reasons for higher aphid densities in these regions.

These studies have thus concluded that different pearl millet cultivar/lines vary in their susceptibility to *S. graminum*. Through these screening studies, resistant and susceptible pearl millet cultivars have been identified. The resistant or moderately resistant entries may be incorporated in breeding programme to minimize aphid infestation and maximize crop yield.

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