International Journal of Agriculture Innovations and Research
Volume 2, Issue 6, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received : 10/05/2014 | Accepted on : 30/05/2014 | Published : 26/06/2014

Screening of Some Sorghum Genotypes for Resistance to Sorghum Midge, *Stenodiplosis sorghicola* (Coq), under Rain-Fed Conditions, Sudan

Aymen Elamein Ali Mansour
ARC, Hudeiba Research Station,
Agricultural Research Corporation, Sudan
Email: aymenarc1@yahoo.com

Seifedawla Seed Ahmed
ARC, Hudeiba Research Station,
Agricultural Research Corporation, Sudan

Abstract **– Field trials were conducted at Abu-Naama Research Station Farm, Sudan during the rainy season 2012/013. Sixteen sorghum genotypes including the released and local varieties were screened and evaluated for resistance to sorghum midge. Based on the parameters such as midge damage rating (MDR), grain yield, panicle type and percent glumes coverage, varieties, Wad Ahmed, Tabat, Gadam Elhamam, Wad Baco and Mogud showed lower MDR (<2), short glumes and semi compact and compact panicle type. While the cultivars Tetron, Safra and Hagein Dura-1 showed higher MDR, long glumes and loose panicle type. The highest grain yield was obtained by Ajeb Seido (1551kg/fed), followed by Gadam Elhamam (1343 kg/fed) and Buttana (1225.1 kg/fed).**

Keywords **– Sorghum, Sorghum Midge, Genotypes, Resistance Varieties.**

I. Introduction

Sorghum (*Sorghum biocoler* L) Moench) is one of the most important cereal crops in Africa, Asia, Americans and Australia. In Sudan, 8% of the total area is grown in the irrigated schemes and 92% in the rain-fed areas[1]. The crop productivity is constrained by many factors; insect pests are among the most important ones. Over 150 insect species damage sorghum worldwide, of them sorghum midge *Stenodiplosis sorghicola* (Coq) is considered as the most destructive [3] Sharma, 1985). It attacks the crop at the flowering stage and the larvae feed on the ovary resulting in chaffy seeds. In late planting and heavy infestation, the damage may reach 100% i.e. complete loss of the crop. Following optimum sowing date and planting resistant cultivars may contribute positively towards reduction of infestation and damage of sorghum midge [4]. The use of host-plant resistance in the management of sorghum midge is therefore most promising as the level of resistance is quite high. The development of resistant varieties offers the best hope of midge control on along-term basis. Considerable progress has been made during the past decade and recent progress has been reviewed by different scientist, within the wider context of plant breeding for resistance to arthropods pests of sorghum. New sources of resistance have been identified, especially in sorghum lines collected in Ethiopia, Sudan and East Africa and screened in the U.S.A [6].The role of morphological characters of the florets, panicle type and glumes length as components of resistance to sorghum midge was studied [7]. There are a number of conflicting reports about the nature and mechanisms of resistance to sorghum midge. According to [2] short glumes coverage and panicle type, may associated to source of resistant to sorghum midge. The objective of this work was to identify resistance genotypes to sorghum midge under rain-fed conditions.

II. Materials and Methods

An experiment was conducted at Abu-Naama Research Station Farm, central clay plains, Sudan, where rain fall range is 350-650 mm with supplementary irrigation to support the crop during season 2012/013. Sixteen sorghum genotypes (Table 1) including susceptible (Um Benain-7 and Daber Baladi) checks were planted late to ensure adequate sorghum midge densities for screening purpose. The sorghum cultivars were laid in a randomized complete block design with four replicates. Plot size was 4×5 m long, inter-row and intra-row spacing was 0.8 m and 0.2 m respectively. All cultural practices as recommended by Agricultural Research Corporation (ARC) were done. Agronomic characters as panicle type and glumes coverage were considered. Each cultivar was evaluated by rating it according to midge damage scale. The damage scale used was a modified [8]. The rating scale used was from 1-9 (1= 1-10%; 2=11-20; 3= 21-30; 4 = 31-40; 5 = 41-50; 6 = 51-60; 7 = 61- 70; 8 = 71-80; 9 = > 80%). Five panicles of each cultivar from each plot were randomly chosen and visually rated. At maturity, two inner rows per each plot were assessed for midge damage and then healthy heads and infested heads were counted separately and percentages of infested heads were calculated. Data on agronomic characters such as panicle type and glumes coverage were recorded, and grain yield measured from 12 m²/plot, then calculated as kg/fed. Data were subjected to analysis of variance (ANOVA) by used MSTAT (soft ware program) and Duncan's Multiple Range Test (DMRT) was used for means separation.

III. Results and Discussion

The differences among genotypes in midge density, midge damage rating (MDR) and grain yield were significantly (P= 0.01) (Table 1). The midge densities ranged between 1.3 to 11.2 adults per five panicles. The MDR scores ranged between 0.7 to 9.9%. Some varieties namely Tetron, Safra and Hagein Dura-1, showed the highest MDR, while Ajeb seido, Gadam Elhamam Tabat, Wad Ahmed, Koracolo, Mogud, Frhoda and Wad Baco

showed the lowest MDR, (Table 1). Cultivars Tetron, Safra and Hagein Dura-1, showed the same MDR as the susceptible checks (Um Benain-7 and Daber Baladi). These findings agreed with Fadlemula [2] who reported the varieties Wad Ahmed , Gadam Elhamam and Mugud were more resistant to sorghum midge in Blue Nile State. The highest grain yield (1551kg/fed) was recoded on Ajeb Seido, followed by Gadam Elhamam (1343 kg/fed) and Buttana (1225.1 kg/fed). Results presented in Table 2 showed significant differences in percent glumes coverage (%GC) among all genotypes (P=0.01). The %GC for the different genotypes ranged 1.4 to 8.8. Varieties Wad Ahmed, Gadam Elhamam, Wad Baco, Frhoda and Mugud showed the short glumes coverage (1.4 to 4.5%), while Tetron and Safra showed the longest glumes (8.8%).Comparison between glumes coverage with adult midge density and midge damage rating (MDR) was shown in Table (3). Genotypes with glumes coverage less than the overall mean had less number of adult midge density and MDR (4.9adults midge and 1.8 respectively), while those with glumes coverage greater than the overall mean had higher midge density and MDR (6.0adult and 4.8 respectively) (Table 3). Panicle type was compared to the number of midge adult and MDR presented in (Table 4). Midge density and MDR were greater than the overall mean in loose panicles (9.8 adult midge and 7.4 respectively) compared to the other types. Semi compact panicles showed relatively lower number of midge adults and MDR than the overall mean (2.8adults midge and 4.6 respectively). Compact panicles had the lowest number of midge adults and MDR than the overall mean (4.2 adults and 1.8 respectively) (Table 4), which is similar to the findings reported by Fadlemula [2].

IV. Conclusion

Based on the parameters such as midge density, midge damage rating (MDR), panicle type and percent glumes coverage; the cultivars Wad Ahmed, Gadam Elhamam, Tabat, Mogud, Koracolo and Wad Baco are more resistant to sorghum midge than the other tested genotypes.

References

[1] Fadlelmula, A. A. (2009). Effects of sowing date on the incidence of sorghum midge, *Stenodiplosis sorghicola* (coq.), (Cecidomyiidae: Diptera) in sorghum (*Sorghum bicolor* L. (Moench) at Damazin rain fed area, Sudan. Sudan J. Agric. Res. Vol. 13, pp. 77-82.

[2] Fdlelmula, A.A., Ahmed E. M., Rudwan M. K. and Abubaker, E, A. (2006). Screening of some sorghum genotypes for resistance to sorghum midge (*Stenodiplosis* = *Contarinia sorghicola*). Proceedings, The 74th Meeting of the National Pests and Diseases Committee. Wad Medani, Sudan. Pp. 40-49.

[3] Harris, K. M. (1976). The sorghum midge. Annual Applied Biology. 84: 114-118.

[4] Mansour, A. E.A. and Mohmoud, M. E. E. (2014). Effects of Sowing Dates and Sorghum Varieties on The Incidence of Sorghum Midge, Stenodiplosis sorghicola (Coq) at Abu-Naama, Sudan. Persian Gulf Crop Protection Journal, ISSN: 2251-9343 (online), Vol. (3), Issue1, March 2014. Pp. 88-91.

[5] Sharma, H. C. (1985). Strategies for pest control in sorghum in India. Tropical Pest Management, 31: 167-185.

[6] Sharma, H. C., Vidyasagar, P. and Leuschner, K. (2000). Components of resistance to sorghum midge, Contarinia sorghicola, Ann. Appl. Biol. Vol. 116. pp. 327-333.

[7] Sharma, H. C. (2005). No-choice cage technique to screen for resistance to sorghum midge (Diptera: Cecidomyiidae). Journal of Economic Entomology, Vol. 81, pp. 415-422.

[8] Wuensche, A. L., Teetes, G. I. and Johnson, J.W. (1981). Field evaluation of converted exotic sorghum for resistance to sorghum midge, Contarinia sorghicola. Texas Agricultural Experimental Station, Texas A&M 1484: 30pp.

Author's Profile

Aymen Elamein Ali
was born in September 1976 in Gedarif State, Sudan. Under graduate from 1997 – 2001 B.Sc., Agriculture Sciences (Pesticides and Toxicology) with second class division one from Faculty of Agriculture of Science University of Gezira, Sudan.
Post Graduate from 2007 – 2010 M.Sc.,
Plant protection, Sudan Academy of Sciences, Sudan.
Work Experience: Research Scientist in Agricultural Research Corporation in Entomology Research Section from 19th January 2010 to till date.
Previous publications:
1. Mansour, A. E.A. and Mohmoud, M. E. E. (2014). Effects of Sowing Dates and Sorghum Varieties on The Incidence of Sorghum Midge, Stenodiplosis sorghicola (Coq) at Abu-Naama, Sudan. Persian Gulf Crop Protection Journal, ISSN: 2251-9343 (online), Vol. (3), Issue1, March 2014. Pp. 88-91.
2.Ali, A. E. and Ali, A. B. (2013). The Biology and Food Consumption of the African Bollworm *Helicoverpa armigera* (Hub.) on Sunflower at Gedarif, Sudan. Journal of Science and Technology Vol. 14. Agricultural and Veterinary Sciences (JAVS No.2). Khartoum, Sudan. pp. 54-60.
3. Ali, A. E. and Ali, A. B. (2013). Effects of some sunflower varieties on the incidence of the African bollworm *(Helicoverpa armigera* Hub.)(Lepidoptera: Noctuidae) at Gedarif rain fed area, Sudan. Sudan Journal Agric. Res.(2013), 2. Agricultural Research Corporation (ARC), Wad Medani, Sudan Pp. 139-144.

Table 1: Mean number of adult midge density, midge damage rating (MDR) and grain yield on different sorghum genotypes at Abu- Naama, Sudan, season 2012/013.

Genotype	Adult midge density	MDR	Grain Yield kg/fed
Tabat	5.1 (26.3) c	1.8 (4.1) a	(873.1) bcde
Wad Ahmed	7.5 (56.3) ef	2.3 (4.8) b	(776.8) cde
ArfaGadamak-8	1.9 (3.5) a	3.1(9.8) bcd	(813.1) bcde
Buttana	6.1 (38.0) d	2.9 (9.8) bc	(1225.1) abc
Bashir	2.5 (6.3) a	3.3 (12.7) bcd	(1207.5) abc
Ajebseido	2.1 (4.5) a	0.7 (0.0) a	(1551.6) a
Gadam Elhamam	6.0(39.3) de	0.7 (0.0) a	(1343.4) ab
UmBinain-7(s.c)	8.4 (73.5) fg	4.7 (21.4) de	(1073.7) abd
Koracolo	2.7 (7.50) ab	2.4 (5.2) b	(1116.4) a

Daber Baladi (s.c)	3.5 (12.2) abc	6.1 (39.7) ef	(742.3) ce
Mogud	6.7 (45.5) def	2.3 (4.8) b	(737.5) cde
Frhoda	4.7 (24.3) bcd	2.5 (6.3) b	(669.7) de
Wad Baco	1.3 (1.3) a	0.7 (0.0) a	(867.7) bc
Hagein Dura-1	8.4 (72.5) fg	6.0 (36.3) ef	(602.9) ef
Safra	9.8 (97.8) gh	6.3 (39.3) f	(605.8) ef
Tetron	11.2 (128) h	9.9 (97.0) g	(114.6) f
SE±	0.661**	0.494**	160.4**
C.V%	24.1	27.3	35.8

Actual data between bracts
Transformed data √x+0.5
Means followed by the same letter are not significantly different at 1%level**.**
**= significant at 0.01.
(S.C) = Susceptible check.
(Feddan= 4200 m²).

Table 2: Panicle type and percent glumes coverage of different sorghum genotypes, Abu- Naama, Sudan, season 2012/013.

Genotype	Panicle type*	Percent glumes coverage**
Tabat	2	4.9 f
Wad Ahmed	2	1.4 g
ArfaGadamak-8	2	7.9 abc
Buttana	2	6.5 de
Bashir	2	6.7 de
Ajeb Seido	2	7.3 cd
Gadam Elhamam	2	1.5 g
UmBinain-7 (s.c)	2	6.0 c
Koracolo	2	4.7 f
Daber Baladi (s.c)	2	7.7 bc
Mogud	1	4.7 f
Frhoda	1	4.5 f
Wad Baco	1	4.3 f
Hagein Dura-1	3	7.9 abc
Safra	3	8.7 ab
Tetron	3	8.8 a
SE±	-	0.3162**
C.V%	-	2.9

*panicle type (1= compact; 2= semi compact; 3= loose)
** Glumes length, (1=10%; 2= 20%;3= 30%; 4= 40%; 5= 50%; 6= 60%; 7= 70%; 8= 80%; 9= 90-100%).
Means followed by the same letter are not significantly different at P= 0.01.
(S.C) = Susceptible check.

Table 3: Comparison of percent glumes coverage with adult midge density and midge damage rating (MDR) Abu-Naama, Sudan, season 2012/013.

Grouping	Midge density	MDR
Genotypes with short glumes coverage	4.9	1.8
Genotypes with long glumes coverage	6.0	4.8
Overall mean	5.5	3.3

Table 4: Comparison of panicle type with adult midge density and midge damage rating (MDR) Abu- Naama, Sudan, season 2012/013

Panicle type	Midge density	MDR
Compact	4.2	1.8
Semi-compact	4.6	2.8
Loose	9.8	7.4
Overall	6.2	4.0