STUDIES ON VARIETAL SCREENING OF WHEAT GENOTYPES/CULTIVARS AGAINST PINK STEM BORER *Sesamia inferens* (Walker)

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ABSTRACT

Twenty six wheat genotypes/cultivars were screened under field conditions for their susceptibility to pink stem borer S. inferens at Agronomy Instructional Farm, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar during rabi 2016-17. Out of twenty six, seventeen genotypes/cultivars of aestivum wheat i.e., GW 473, GW 479, GW 480, GW 322, GW 366, GW 496, Lok 1, GW 273, GW 173, GW 11, GW 477, GW 485, GW 451, HI 8781, VA 2015-05, VA 2015-06, VA 2015-07 and nine of durum wheat i.e., Raj 1555, GW 1139, GDW 1255, VD 2014-09, VD 2014-14, VD 2014-15, VD 2015-14, GW 1328, HI 8498. Among aestivum wheat, GW 451 was found superior recording less dead heart (3.02 %) followed by GW 322 (3.71 %) and GW 366 (3.85 %). None of the durum wheat genotypes/cultivars recorded less than 4.00 per cent dead heart, however, comparatively lower (4.95 %) damage was noticed in GDW 1255. On the basis of categorization, genotypes/cultivars viz., GW 451, GW 322 and GW 366 of aestivum wheat and GDW 1255 of durum wheat were categorized as resistant. Genotypes/cultivars viz., GW 273, GW 473, GW 496, GW 479, VA 2015-07, HI 8781 and GW 485 of aestivum wheat and VD 2014-14, HI 8498 and VD 2015-14 of durum wheat were found moderately resistant to S. inferens, whereas Lok 1 and GW 477 of aestivum wheat and Raj 1555 of durum wheat were found susceptible to this pest.

KEY WORDS: aestivum, Cultivars, Dead heart, durum, Genotypes, Pink stem borer, Screening, Wheat

INTRODUCTION

Wheat, *Triticum aestivum* L., is an important cereal crop grown in diversified environments. Next to rice, wheat is the most important food- grain of India and is the staple food of millions of Indians, particularly in the northern and north-western parts of the country. It is consider as the principle food of human being, the properties of gluten in wheat are such that, it produces bread stuffs, generally superior to those from any other cereal grains, it is grounded into flour to make different kinds of foods and bakery item like bread, porridge, crackers, biscuits, Muesli, pancakes, pies, pastries, cakes, cookies, muffins, rolls, doughnuts, gravy and breakfast cereals. Because of its excellent baking quality, wheat has become the most important source of carbohydrates and

protein makes it more important human food as compared to other cereal grains in the majority of countries in temperate zone. A small amount of wheat is also used in manufacturing of dextrose, alcohol and certain breakfast food.

The minor insect pests like pink stem borer, *Sesamia inferens* Walker and gram pod borer, *Helicoverpa armigera* (Hubner) are becoming major pests of wheat in India due to change in environment and tillage system. Among the various pests attacking this crop, the wheat pink stem borer is a polyphagous pest occurring in almost all the wheat growing countries in Asia. In India, the pest was recorded for the first time in wheat by Patel (1972). Singh and Kular (2015) included pink stem borer in the list of emerging pests of different crops. Dhaliwal *et al.* (2010) described it as a well established pest of wheat. The pest is active during the month of December to March (Godhani, 1987).

The pinkish brown caterpillar of *S. inferens* with cylindrical body bores into the stem, feed on tissues inside and gradually kill the central shoot of the plant, thus, causing "Dead heart" (Deol, 2002). The infected ear heads may not bear grains which expressed as 'white ears' (Deol, 2002 and Singh, 2012) and the yield is directly affected. Wheat is damaged by the over-wintering to first generations larvae in some regions of China, the average per cent damage ranged from 6.17 to 9.83 per cent (Lina *et al.*, 2012).

Keeping in view the importance of the wheat crop and the damages caused *Sesamia inferens* to it, the present experiments aimed to studies on varietal screening of wheat genotypes/cultivars against pink stem borer.

MATERIALS AND METHODS

The present study was conducted at the Agronomy Instructional Farm, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *rabi* season of 2016-17 to screen the relative resistance/susceptibility of 26 genotypes/cultivars of wheat to wheat pink stem borer (*Sesamia inferens*) using Randomized Block Design (RBD) replicated thrice. Experimental plot was kept free from insecticidal spray and all the agronomical practices were followed. Each variety was grown in strip of 4.00 m x 0.45 m with recommended cultivation practices. Observations on number of tillers showing dead heart symptoms and healthy total tillers per genotypes/cultivars were recorded from one meter row length at weekly interval during morning hours starting from two weeks after sowing till the maturity of the crop. The data, thus, obtained were subjected to statistical analysis for susceptibility test of different genotypes/ cultivars against this pest.

Selection of genotypes/cultivars

In order to screen the relative susceptibility of different wheat genotypes/cultivars to wheat pink stem borer, 17 genotypes/cultivars from *aestivum* (Table 1) and 9 from *durum* wheat (Table 2) were screened.

The percentage of dead heart damage was recorded with the help of following formula:

$$\text{Dead heart (\%)} = \frac{\text{No. of dead heart tillers}}{\text{Total no. of tillers}} \times 100$$

The different wheat varieties were also categorized into Highly Resistant (HR), Resistant (R), Moderately Resistant (MR), Moderately Susceptible (MS), Susceptible (S) and Highly Susceptible (HS) following statistical scale given in Table 3 (Dindor, 2015). For the purpose, the mean value (per cent damaged plants) of genotypes/cultivars (X_i) was compared with mean value of all the genotypes/cultivars (X) and Standard Deviation (S.D.).

RESULTS AND DISCUSSION

Screening of wheat genotypes/cultivars for susceptibility to *S. inferens*

Per cent dead heart due to S. inferens in aestivum wheat

The data on pooled over periods are presented in Table 4 and depicted in Figure 1. The dead heart ranged from 3.02 to 6.66 per cent among different genotypes/cultivars. The lower (3.02 %) dead heart was observed in GW 451, which was found at par with GW 322 (3.71 %), GW 366 (3.85 %), GW 273 (4.20 %), GW 473 (4.34 %), GW 496 (4.34%) and GW 479 (4.36 %). Wheat genotypes/cultivars VA 2015-07, HI 8781 and GW 485 recorded 4.52 to 4.63 per cent dead heart caused by *S. inferens* and found mediocre in terms of susceptibility. However, higher per cent dead heart due to *S. inferens* was noticed in VA 2015-06 (6.66 %) and it was at par with GW 477 (6.04 %), Lok 1 (5.71 %), VA 2015-05 (5.43 %), GW 173 (5.21 %), GW 480 (5.14 %) and GW 11 (5.09 %). The chronological order of wheat genotypes/cultivars based on per cent damaged plants was: GW 451< GW 322< GW 366< GW 273< GW 473= GW 496< GW 479< VA 2015-07< HI 8781< GW 485< GW 11< GW 480< GW 173< VA 2015-05< Lok 1< GW 477< VA 2015-06.

Per cent dead heart due to S. inferens in durum wheat

The data on pooled over periods are shown in Table 5 and depicted in Figure 2. The per cent dead heart ranged from 4.95 to 9.39 among different genotypes/cultivars of *durum* wheat. The lower (4.95 %) dead heart was observed in GDW 1255, which was found at par with VD 2014-14 (5.80 %), HI 8498 (5.89 %) and VD 2015-14 (6.81 %). Wheat genotypes/cultivars GW 1139 recorded 7.22 per cent dead heart caused by *S. inferens* and found mediocre in terms of susceptibility. However, higher per cent dead heart due to *S. inferens* was noticed in Raj 1555 (9.39 %) and it was at par with VD 2014-09 (8.06 %), GW 1328 (7.94 %) and VD 2014-15 (7.63 %). The chronological order of wheat genotypes/cultivars based on per cent damaged plants was: GDW 1255< VD 2014-14< HI 8498< VD 2015-14< GW 1139< VD 2014-15< GW 1328< VD 2014-09< Raj 1555.

Grain yield

Aestivum wheat

The data on grain yield at harvest are presented in Table 4 and depicted in Figure 1 clearly revealed that the yield ranged from 3052 to 4534 kg per hectare among different genotypes/cultivars. Among the genotypes/cultivars, GW 451 yielded the highest (4534 kg/ha) and it was at par with GW 322 (4377 kg/ha), GW 366 (4370 kg/ha), GW 273 (4314 kg/ha), GW 473 (4278 kg/ha), GW 496 (4132 kg/ha), GW 11 (4080 kg/ha), GW 485 (4029 kg/ha), GW 173 (4012 kg/ha), HI 8781 (3965 kg/ha) and GW 477 (3955 kg/ha). Genotypes/cultivars *viz*., GW 480, VA 2015-07, GW 479 and VA 2015-05 recorded 3730 to 3889 kg wheat grains per hectare. The lowest grain yield was harvested from Lok 1 with 3052 kg per hectare and it was found at par with VA 2015-06 (3425 kg/ha). The chronological order of wheat genotypes/cultivars based on grain yield (kg/ha) was: GW 451> GW 322> GW 366> GW 273>GW 473> GW 496> GW 11> GW 485> GW 173> HI 8781> GW 477> VA 2015-05> GW 479> VA 2015-07> GW 480> VA 2015-06> Lok 1.

Durum wheat

The data on grain yield are presented in Table 5 and depicted in Figure 2 clearly revealed that the yield ranged from 2694 to 3410 kg per hectare among different genotypes/cultivars. Among the genotypes/cultivars, VD 2015-14 yielded highest (3410 kg/ha) and it was at par with GDW 1255 (3398 kg/ha), VD 2014-14 (3368 kg/ha), GW 1328 (3337 kg/ha), GW

1139 (3278 kg/ha) and HI 8498 (3171 kg/ha). The lowest grain yield was harvested from Raj 1555 with 2694 kg per hectare and it was found at par with VD 2014-09 (2885 kg/ha) and VD 2014-15 (2888 kg/ha). The chronological order of wheat genotypes/cultivars based on grain yield (kg/ha) was: VD 2015-14 > GDW 1255> VD 2014-14> GW 1328> GW 1139> HI 8498> VD 2014-15> VD 2014-09> Raj 1555.

Overall, it can be concluded on the basis of per cent damaged plants, some genotypes/cultivars have less damage by *S. inferens* and probably due to higher yield compared with other genotypes/cultivars. In case of *aestivum* genotypes/cultivars *viz.*, GW 451, GW 322 and GW 366 performed well, whereas in *durum* GW 1255 stood better in the screening. However, higher per cent dead heart in *aestivum* genotypes/cultivars due to *S. inferens* was noticed in VA 2015-06 (6.66 %) and in case of *durum* genotypes/cultivars higher per cent dead heart due to *S. inferens* was noticed in Raj 1555 (9.39 %). According to Godhani (1987) among the various varieties tested for their susceptibility to this pest under normal sown conditions, a variety Lok 1 showed 3.22 per cent infestation which was the lowest as compared to the rest of the varieties. It was also found that the variety J 24 was more susceptible to this pest with 7.65 per cent infestation. In contrast, Lok 1 was found highly infested with *S. inferens* in the resent investigation which might be due to the gradual changes in the climate as well as changes in the location and continuous sowing of this variety leads to susceptible to *S. inferens*. Anonymous (1980 and 1983) reported that the among the normal sown wheat varieties *viz.,* Lok 1, J 325, WH 291, V 7, Raj 1555, Raj 1972, Raj 1802, HI 784, WL 711, and HD 2236 showed less infestation of this pest and when the same group was tested under late conditions the varieties Lok 1, J 40, HI 2236 were also found less infested by this pest in North Gujarat. Based on the present result also found Raj 1555 was heavily infested with *S. inferens* which are in conformity with the results of Godhani (1987) and Anonymous (1980 and 1983).

Categorization of wheat genotypes/cultivars for susceptibility to S. inferens

The different wheat genotypes/cultivars were also categorized into Highly Resistant (HR), Resistant (R), Moderately Resistant (MR), Moderately Susceptible (MS), Susceptible (S) and Highly Susceptible (HS) following statistical scale given in Table 6. For the purpose, the mean value (per cent dead heart) of genotypes/cultivars ($\bar{X}_i$) was compared with mean value of all the genotypes/cultivars ($\bar{X}$) and standard deviation (SD).

Aestivum wheat

None of the genotypes/cultivars were found highly resistant to *S. inferens*. However, genotypes/cultivars *viz.*, GW 451 (3.02 %), GW 322 (3.71 %) and GW 366 (3.85 %) recorded less than 3.85 per cent damaged plants and falls under resistant (R) category. Genotypes/cultivars *viz.*, GW 273 (4.20 %), GW 473 (4.34 %), GW 496 (4.34 %), GW 479 (4.36 %), HI 8781 (4.57 %), GW 485 (4.63 %) and VA 2015-07 (4.52 %) recorded less than 4.75 but more than 3.85 per cent damaged plants and falls under category moderately resistant (MR); and genotypes/cultivars GW 11 (5.09 %), GW 480 (5.13 %) and GW 173 (5.21 %) recorded less than 5.65 per cent but more than 4.75 per cent damaged plants falls under category moderately susceptible (MS); genotypes/cultivars Lok 1 (5.71 %) and GW 477 (6.04 %) recorded less than 6.55 per cent but more than 5.65 per cent damaged plants falls under category susceptible (S); whereas VA 2015-06 was

found highly susceptible, which recorded 6.66 per cent damaged plants.

Durum wheat

Among the nine genotypes/cultivars screened, none of the genotypes/cultivars were found highly resistant or highly susceptible to *S. inferens*. However, GDW 1255 recorded less than 4.95 per cent damaged plants and falls under resistant (R) category; genotypes/cultivars *viz.*, VD 2014-14 (5.80 %), VD 2015-14 (6.81 %) and HI 8498 (5.89 %) recorded less than 7.08 but more than 5.71 per cent damaged plants and falls under category moderately resistant (MR); and genotypes/cultivars *viz.*, GW-1139 (7.22 %), VD 2014-09 (8.06 %), VD 2014-15 (7.63 %) and GW 1328 (7.94 %) recorded less than 8.45 per cent but more than 7.08 per cent damaged plants falls under category moderately susceptible (MS); Raj 1555 (9.39 %) recorded less than 9.82 per cent but more than 8.45 per cent damaged plants falls under category susceptible (S).

The varieties studied for their susceptibility to *S. inferens* under field condition by earlier researcher was different from the varieties under present investigation and hence the present findings could not be compared.

CONCLUSION

Based on per cent damaged plants. Among *aestivum* wheat, GW 451 was found superior recording less dead heart (3.02 %) and it was found at par with GW 322 (3.71 %), GW 366 (3.85 %), GW 273 (4.20 %), GW 473 (4.34 %), GW 496 (4.34%) and GW 479 (4.36 %). In case of *durum* wheat, comparatively lower (4.95 %) dead heart was observed in GDW 1255 which was found at par with VD 2014-14 (5.80 %), HI 8498 (5.89 %) and VD 2015-14 (6.81 %). As far as grain yield is concerned, GW 451 (4534 kg/ha) and VD 2015-14 (3410 kg/ha) were proved to be the high yielding genotypes/cultivars of *aestivum* and *durum* wheat, respectively. Based on per cent dead hearts; none of the genotypes/cultivars were found highly resistant to the pest. However, genotypes/cultivars *viz.*, GW 451, GW 322 and GW 366 of *aestivum* wheat and GDW 1255 of *durum* wheat were categorized under resistant (R). Genotypes/cultivars *viz.*, GW 273, GW 473, GW 496, GW 479, VA 2015-07, HI 8781 and GW 485 of *aestivum* wheat and VD 2014-14, HI 8498 and VD 2015-14 of *durum* wheat were found moderately resistant to *S. inferens*, whereas Lok 1 and GW 477 of *aestivum* wheat and Raj 1555 of *durum* wheat were found susceptible to this pest.

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Table 1: Genotypes/ cultivars of wheat (*T. aestivum*) screened against *S. inferens*

Sr. No.	Genotypes/ Cultivars	Sr. No.	Genotypes/ Cultivars	Sr. No.	Genotypes/ Cultivars
1.	GW 473	7.	Lok 1	13.	GW 451
2.	GW 479	8.	GW 273	14.	HI 8781
3.	GW 480	9.	GW 173	15.	VA 2015-05
4.	GW 322	10.	GW 11	16.	VA 2015-06
5.	GW 366	11.	GW 477	17.	VA 2015-07
6.	GW 496	12.	GW 485		

Table 2: Genotypes/ Cultivars of wheat (*T. durum*) screened against *S. inferens*

Sr. No.	Genotypes/ Cultivars	Sr. No.	Genotypes/ Cultivars	Sr. No.	Genotypes/ Cultivars
1.	Raj 1555	4.	VD 2014-09	7.	VD 2015-14
2.	GW 1139	5.	VD 2014-14	8.	GW 1328
3.	GDW 1255	6.	VD 2014-15	9.	HI 8498

Table 3: Scale for categorization of genotypes/cultivars for resistance

Categories	Scale
Highly Resistant (HR)	X_i < (X- 2 S.D.)
Resistant (R)	X_i < (X + 2 S.D.) > (X- S.D.)
Moderately Resistant (MR)	X_i < (X – S.D.) > X
Moderately Susceptible (MS)	X_i < X > (X + S.D.)
Susceptible (S)	X_i < (X + S.D.) > (X + 2 S.D.)
Highly Susceptible (HS)	X_i > (X + 2 S.D.)

Table 4: Screening of different genotypes/cultivars of wheat against *S. inferens*

Sr. No.	Genotypes/Cultivars	Dead Heart (%)	Yield (Kg/ ha)
1.	GW 473	12.71 (4.34)*	4278
2.	GW 479	12.73 (4.36)	3781
3.	GW 480	13.74 (5.14)	3730
4.	GW 322	11.84 (3.71)	4377
5.	GW 366	12.04 (3.85)	4370
6.	GW 496	12.70 (4.34)	4132
7.	Lok 1	14.43 (5.71)	3052
8.	GW 273	12.53 (4.20)	4314
9.	GW 173	13.83 (5.21)	4012
10.	GW 11	13.68 (5.09)	4080
11.	GW 477	14.82 (6.04)	3955
12.	GW 485	13.09 (4.63)	4029
13.	GW 451	10.82 (3.02)	4534
14.	HI 8781	13.02 (4.57)	3965
15.	VA 2015-05	14.09 (5.43)	3889
16.	VA 2015-06	15.51 (6.66)	3425
17.	VA 2015-07	12.95 (4.52)	3746
S.Em. ±		0.77	210.84
C.D. at 5%		2.23	587.89
C.V. %		10.14	9.17

Figures inside parenthesis are indicates retransformed values of arcsine transformation

Table 5: Screening of different genotypes/cultivars of wheat (*T. durum*) against *S. inferens*

Sr. No.	Genotypes/Cultivars	Dead Heart (%)	Yield (kg /ha)
1.	Raj 1555	18.32 (9.39)*	2694
2.	GW 1139	16.13 (7.22)	3278
3.	GDW 1255	13.50 (4.95)	3398
4.	VD 2014-09	17.00 (8.06)	2885
5.	VD 2014-14	14.54 (5.80)	3368
6.	VD 2014-15	16.56 (7.63)	2888
7.	VD 2015-14	15.69 (6.81)	3410
8.	GW 1328	16.88 (7.94)	3337
9.	HI 8498	14.64 (5.89)	3171
S.Em. ±		0.85	165.89
C.D. at 5%		2.55	497.36
C.V. %		9.20	9.10

Figures inside parenthesis are indicates retransformed values of arcsine transformation

Table 6: Categorization of wheat genotypes/cultivars based on dead heart due to *S. inferens*

Category of resistance	Scale	Genotypes/Cultivars
Based on Dead hearts (%) in *T. aestivum* X = 4.75		**S.D. = 0.90**
Highly Resistant (HR)	$X_i < 2.95$	-
Resistant (R)	$2.95 < X_i > 3.85$	GW 451 (3.02), GW 322 (3.71), GW 366 (3.85)
Moderately Resistant (MR)	$3.85 < X_i > 4.75$	GW 273 (4.20), GW 473 (4.34), GW 496 (4.34), GW 479 (4.36), VA 2015-07 (4.52), HI 8781 (4.57), GW 485 (4.63)
Moderately Susceptible (MS)	$4.75 < X_i > 5.65$	GW 11 (5.09), GW 480 (5.13), GW 173 (5.21),
Susceptible (S)	$5.65 < X_i > 6.55$	Lok 1 (5.71), GW 477 (6.04)
Highly Susceptible (HS)	$X_i > 6.55$	VA 2015-06 (6.66)
Based on Dead hearts (%) in *T. durum* X = 7.08		**S.D. = 1.37**
Highly Resistant (HR)	$X_i < 4.34$	-
Resistant (R)	$4.34 < X_i > 5.71$	GDW 1255 (4.95)
Moderately Resistant (MR)	$5.71 < X_i > 7.08$	VD 2014-14 (5.80), HI 8498 (5.89), VD 2015-14 (6.81)
Moderately Susceptible (MS)	$7.08 < X_i > 8.45$	GW 1139 (7.22), VD 2014-15 (7.63), GW 1328 (7.94), VD 2014-09 (8.06)
Susceptible (S)	$8.45 < X_i > 9.82$	Raj 1555 (9.39)
Highly Susceptible (HS)	$X_i > 9.82$	-

X = Mean value of all genotypes/cultivars.
X_i = Mean value of individual genotype/cultivar

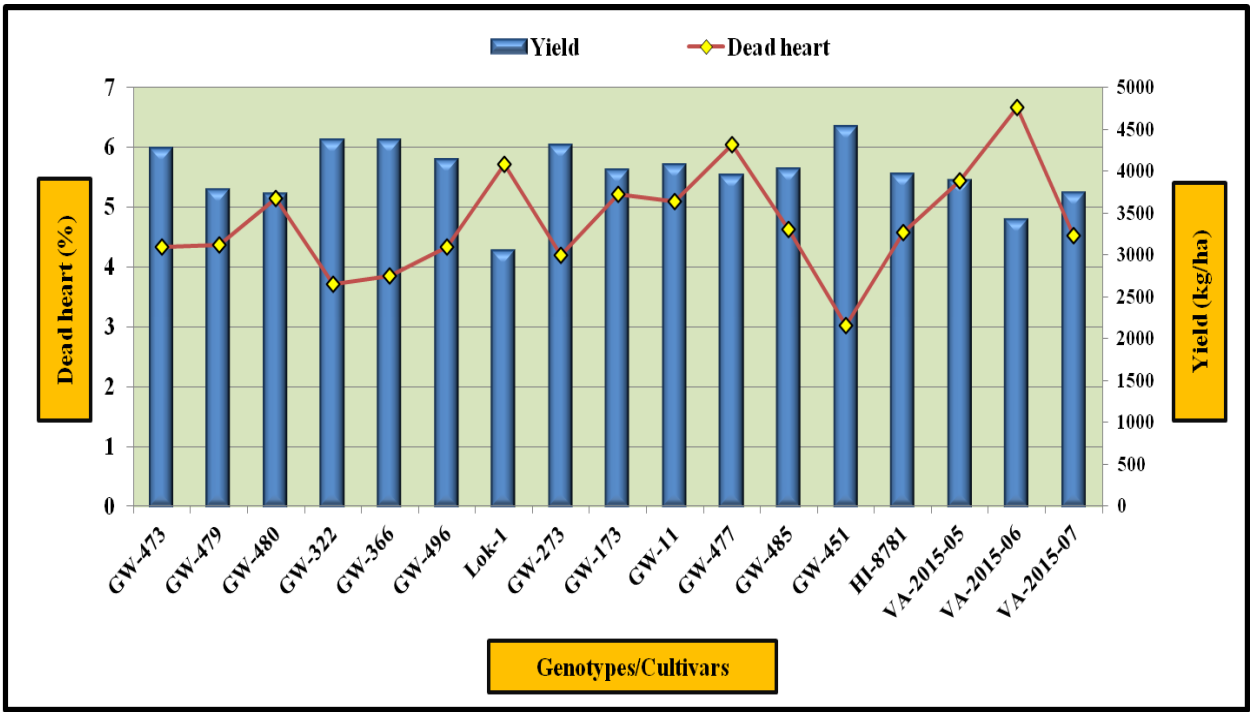

Fig. 1. Screening of different genotypes/ cultivars of wheat (Triticum aestivum) against S. inferens

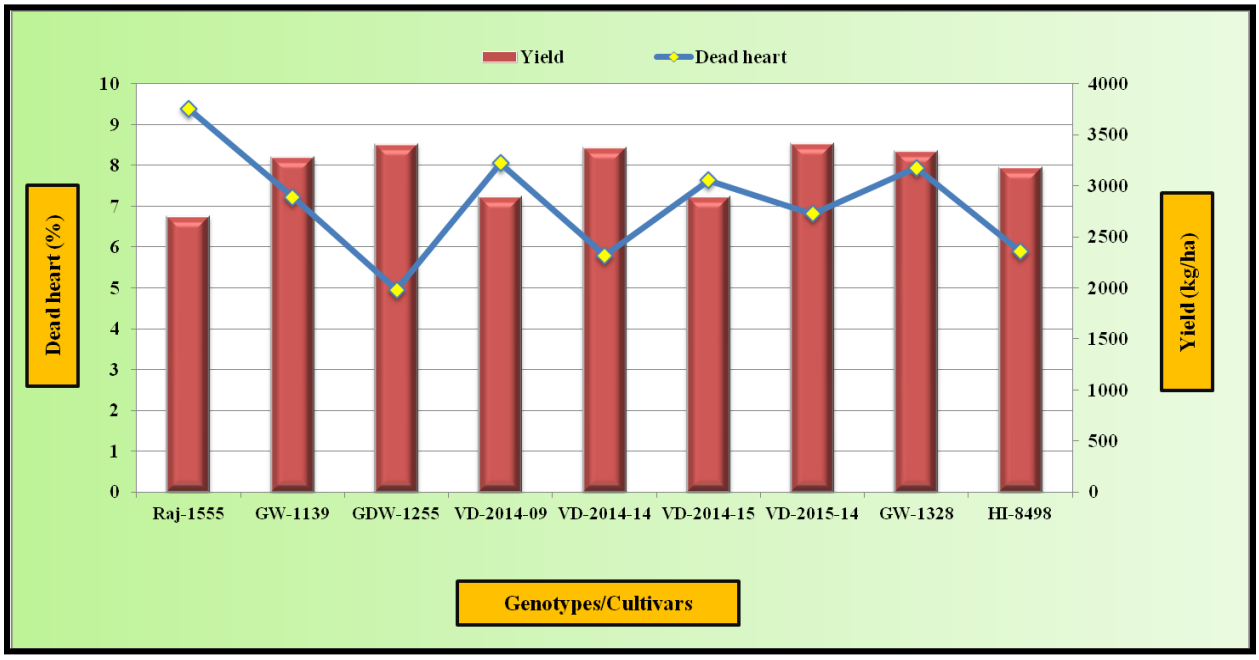

Fig. 2. Screening of different genotypes/ cultivars of wheat (Triticum durum) against S. inferens

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