Indian J. Genet., 70(2): 204-206 (2010)

Short Communication

Improvement of resistance level in selected maize genotypes through cycles of selection against pink borer, *Sesamia inferens* Walker

J. C. Sekhar, Sujay Rakshit[1], Pradyumn Kumar[2], S. Venkatesh, Rakesh K. Sharma[3], M. Anuradha[4], R. Sai Kumar[4] and Sain Dass[2]

Winter Nursery Center, Directorate of Maize Research, Rajendranagar, Hyderabad 500 030
[1]Directorate of Sorghum Research, Rajendranagar, Hyderabad
[2]Directorate of Maize Research, Pusa campus, New Delhi 110 012
[3]Division of Entomology, IARI, New Delhi 110 012
[4]Maize Research Center, ARI, Rajendranagar, Hyderabad 500 030

(Received: January 2009; Revised: March 2010; Accepted: May 2010)

Pink borer (*Sesamia* spp.) is an important insect pest of maize (*Zea mays* L.). In India two species of *Sesamia viz*., *S. inferens* Walker and *S. uniformis* Dudgeon are reported [1] *S. inferens* is predominant throughout the year in the Peninsular India, particularly in the states of Andhra Pradesh, Karnataka, Tamil Nadu and Maharastra. During *rabi* season it also causes extensive damage to the maize crop in several northern states like Uttar Pradesh, Assam, Bihar, Delhi, Punjab, Orissa, Madhya Pradesh, Haryana, West Bengal and Andaman islands. The adults pink borer lays eggs inside the leaf sheath. The typical symptoms of pink borer damage are gummy oozing with water soaked lesions at the bottom of leaf sheaths, oblong holes in unfolded leaves, drying of central shoots and dead heart in young plants [2]. Losses due to *S. inferens* in *rabi* season varies from 25.7 to 78.9 percent [3]. causing an estimated loss of 11.05 crore rupees in India annually [4]. Thus effective control of pink borer may significantly contribute towards augmenting yield potential of *rabi* maize across the country and in *kharif* and *rabi* maize in peninsular India. Resistance breeding holds immense potential in controlling this pest in a durable and ecologically sustainable manner. However, resistant lines fully acclimatized to Indian conditions which can be utilized directly in insect resistance breeding programme, is limiting. Though a few tolerant lines, *viz*., CML67 and CML139 are available, it could not be acclimatized to our conditions because of their poor performance under low N conditions [5]. Thus there is an emerging need to develop materials with improved level of resistance/ tolerance to pink borer which are suitable to Indian growing environment.

Sixty two lines received from CIMMYT, Mexico were screened against pink borer during *rabi* 2000 and based on leaf injury rating (LIR) 8 were selected as resistant lines [6]. These 8 genotypes were taken up for further improving the level of tolerance and acclimatizing these genotypes under Indian condition. In each generation the lines were screened under artificial infestation of pink borer and plants with LIR < 5.0 were selected during *rabi* 2001, 2002, 2003, 2004 and advanced through ear-to-row method during *kharif* 2001, 2002, 2003. After four cycles of inbreeding under artificial selection and three cycles of selfing during *kharif* 2001, 2002 and 2003, these eight genotypes were evaluated during *rabi* 2005 against pink borer along with one resistant and one susceptible check, CM 500 and CM 300, respectively. The lines were evaluated under artificial infestation in randomized block design with three replications in a 2.5 m row plots with inter and

Corresponding author's e-mail: srakshit@rediffmail.com
Published by Indian Society of Genetics & Plant Breeding, F2, First Floor, NASC Complex, PB#11312, IARI, New Delhi 110 012
Online management by indianjournals.com

Table 1. Comparative susceptibility of different maize lines against *S. inferens*

Genotype*	Origin	Mean Leaf injury rating on 1-9 scale		
		2000**	2005	Percent improvement in resistance in terms of LIR after four cycles of selection
WNZPBTL1	MIRTC4AmF36-B-2-2-B	3.7±0.7	2.4±0.1	18.9
WNZPBTL2	MIRTC4AmF86-B-3-1-B	3.3±0.4	2.7±0.4	18.2
WNZPBTL3	MIRTC4AmF150-B-1-3-B	4.4±0.6	3.2±0.3	27.3
WNZPBTL4	MIRTC4AmF110-B-1-1-B	3.3±0.3	3.2±0.2	3.3
WNZPBTL5	PT963034-B-B-B-B-B-B	4.2±0.5	3.2±0.4	23.8
WNZPBTL6	PT963080- B-B-B-B-B-B	5.4±0.2	3.5±0.1	35.2
WNZPBTL7	PT963112- B-B-B-B-B-B	3.3±0.6	3.0±0.1	9.1
WNZPBTL8	PT963128- B-B-B-B-B-B	3.7±0.5	2.6±0.2	29.7
CM500 (Resistant check)	AICMIP	3.0±0.3	4.8±.2	-
CM300 (Susceptible check)	AICMIP	7.1±0.3	6.6±0.2	-
CD (p=0.05)	-	0.66	0.44	

*WN: Winter Nursery; Z: Hyderabad and PBTL: Pink Borer Tolerant Line
**LIR of the selected genotypes were taken as base material from 64 genotypes including reisitant and susceptible check screened earlier (Sekhar *et al.*, 2004)

intra row spacing of 75 cm and 20 cm, respectively. In each replication ten infested plants were considered for evaluation. LIR was recorded in all the treatments thirty days after infestation on 1-9 scale [7].

The leaf injury ratings (LIR) of the eight lines along with susceptible and resistant checks in different seasons are presented in Table 1. The mean LIR of all the eight lines in 2000 and 2005 *rabi* clearly suggested significant response to cyclic selection for improvement in resistance to *S. inferens*. The mean LIR at initial selection varied from 3.3 to 4.4 as against resistant check, CM 500 (3.0) and susceptible check, CM 300 (7.1). After the four cycles of selection of the lines under artificial infestation with the target insect, there was clear improvement in the level of resistance to pink borer by reduced leaf injury among the lines. Maximum percent of reduction in terms of LIR was observed in WNZPBTL6 (35.2%) and lowest in WNZPBTL4 (3.3%). Lines WNZPBTL3, WNZPBTL5 and WNZPBTL8 had more than 20% improvement. Similar kind of response to cyclic selection under artificial infestation of stalk borers in MIRT and MBR populations was reported in tropical maize by Bergvinson and Garcia Lara [8]. It suggested accumulation of minor genes for resistance among the lines over generations [5]. Burton *et al*. [9] reported stable transmission of resistance against pink stem borer, *S. nonagrioides* Lef to the hybrids through the resistant parental lines. In the present investigation simultaneous selection at each generation was made for important agronomic traits like plant height, ear height, days to silking and 100 seed weight. This resulted into not only improvement of the lines in terms of pink borer resistance but for agronomic traits as well (Table 2). All the lines were of medium height and medium ear placement with days-to-silking 72-83 days and 100-seed weight 12-5-23.0 g. Thus the identified lines which are acclimatized to Indian conditions may be used in development of *S. inferens* resistant hybrids and synthetics. These lines can also be used as checks while screening the germplasm against pink borer. The identified lines may also be used to study the genetics of pink borer resistance and identification of QTLs responsible for pink borer resistance.

Table 2. Plant Characters of Pink borer Tolerant lines

Genotypes	Plant height (cm)	Ear height (cm)	Days to silking	100 seed wt. (g)
WNZPBTL1	148	95	83	21.0
WNZPBTL2	134	87	74	18.6
WNZPBTL3	110	76	72	20.7
WNZPBTL4	132	93	74	23.0
WNZPBTL5	136	91	73	18.0
WNZPBTL6	136	88	73	15.7
WNZPBTL7	138	91	72	13.5
WNZPBTL8	144	85	74	12.5

References

1. **Ghai S., Ramamurthy V. V. and Gupta S. L.** 1979. Lepidopterous insects associated with rice crop in India. Indian J. Ent., **41**: 65-90.
2. **Reddy M. L. K., Ramesh Babu T. and Venkatesh S.** 2003. A new rating scale for *Sesamia inferens* (Walker) (Lepidoptera: Noctuidae) damage to maize. Insect science and its application, **23**: 293-299.
3. **Chatterji S. M., Young W. R., Sharma G. C., Sayi I. V., Chahal B. S., Khare B. P., Rathore Y. S., Panwar V. P. S. and Siddiqui K. H.** 1969. Estimation loss in yield of maize due to insect pests with special reference to borers. Indian J. Ent., **32**: 209-213.
4. **Siddiqui K. H. and Marwaha K. K.** 1993. The vistas of maize entomology in India. Pp. 184 Kalyani Publishers, New Delhi.
5. **Bergvinson D. J., Vasal S. K., Singh N. N., Panwar V. P. S. and Sekhar J. C.** 2002. Advances in conventional breeding for insect resistance in tropical maize. pp. 325-338. *In*: Proceedings of Eighth Asian Regional Maize Workshop held at Bangkok, Thailand, August, 5-8, 2002.
6. **Sekhar J. C., Bergvinson D. J., Venkatesh S., Sharma R. K., Reddy M. L. K. and Singh N. N.** 2004. Reaction of exotic maize germplasm to pink borer *Sesamia inferens* Walker. Indian J. Ent., **66**: 261-263.
7. **Rao A. B.** 1983. Techniques of scoring for resistance to maize stalk borer (Sesamia *inferens*). *In*: Techniques of scoring for resistance to the major insect pests of maize, AICMIP Pp. 16-26.
8. **Bergvinson D. J. and Garcia L. S.** 2002. Intra-population improvement for stem borer and armyworm resistance in tropical maize. Arnel and Hallaeur International Symposium on Plant Breeding, 17-22 August, 2002, Mexico City.
9. **Butron A., Malavar R. A., Revilla P., Velasco P. and Ordas A.** 1997. Breeding maize for resistance to pink stem borer. p. 87. *In*: Agronmy Abstracts. ASA, Madison, WI.