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Short Communication

Advanced chickpea lines resistant against fusarium wilt (*Fusarium oxysporum*)

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Chickpea is one of the major grain legume crops grown widely in South Asia, Indian sub-continent and Sub-Saharan Africa, providing income to the subsistence farmers residing in these regions (Gaur *et al.* 2012). It also serves as a key source of plant-based dietary protein and essential micronutrients to the global human population (Jukanti *et al.* 2012). Among the various biotic stresses, FW remains one of the major constraints to global chickpea production causing substantial chickpea yield losses (Gupta *et al.* 2009). FW even causes 100% chickpea yield loss under favourable conditions (Jendoubi *et al.* 2017, Jha *et al.* 2020). Thus, breeding for FW resistant remains one of the prime objectives for developing high yielding sustainable chickpea cultivars.

Here, we screened 75 advanced chickpea line including one FW resistant and one FW susceptible check. We obtained 30 FW resistant and 334 MR FW advanced breeding lines that could be directly released as FW resistant varieties or could be used as genetic stock for transferring FW resistance in high yielding yet FW susceptible elite chickpea varieties. A total of 75 chickpea advanced breeding lines along with WR 315 (FW resistant check) and JG 62 (FW susceptible check) (Table 1) were evaluated for two consecutive years 2016 and 2017 in wilt sick plot nursery at Indian Institute of Pulses Research, Kanpur, India. The genotypes were sown during the first week of November for both the year 2016 and 2017. The tested genotypes were sown in 60 cm × 10 cm spacing. The row length was kept 3 m. The susceptible

Table 1 Fusarium wilt reaction in 75 chickpea genotypes during 2016 and 2017

Genotype	Status	Type	% FW incidence recorded in Year 2016	% FW incidence recorded in Year 2017	Mean	Disease reaction
JG 62 (Susceptible check)	Released variety	Desi	100	100	100	S
IPC 2005-45	Advanced breeding line	Desi	3.55	8	5.77	R
IPC 2005-37	Advanced breeding line	Desi	11.6	15.45	13.5	MR
IPC 2005-35	Advanced breeding line	Desi	13.6	15	14.3	MR
IPC 2004-08	Advanced breeding line	Desi	16.1	16.5	16.3	MR
IPC 2005-64	Advanced breeding line	Desi	16.7	11.6	14.15	MR
IPC 2005-15	Advanced breeding line	Desi	10.25	11.25	10.75	MR
IPC 2005-34	Advanced breeding line	Desi	26.5	18.75	22.6	S
IPC 2005-59	Advanced breeding line	Desi	13.35	17.65	15.5	MR
IPC 2005-30	Advanced breeding line	Desi	19.6	21.9	20.75	MR
IPC 2005-62	Advanced breeding line	Desi	13.55	11.45	12.5	MR
IPC 2005-44	Advanced breeding line	Desi	11.85	13.85	12.85	MR
IPC 2005-54	Advanced breeding line	Desi	27.85	20.5	24.17	S
IPC 2005-43	Advanced breeding line	Desi	45.55	49.7	47.62	S
IPC 2005-41(b)	Advanced breeding line	Desi	16.75	10.8	13.77	MR
IPC 2005-18	Advanced breeding line	Desi	12.7	8	10.35	MR

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Table 1 (*Continued*)

Genotype	Status	Type	% FW incidence recorded in Year 2016	% FW incidence recorded in Year 2017	Mean	Disease reaction
IPC 2005-27	Advanced breeding line	Desi	38	35	36.5	S
IPC 2004-03	Advanced breeding line	Desi	15.55	16.25	15.9	MR
IPC 2005-46	Advanced breeding line	Desi	17.1	9.3	13.2	MR
IPC 2005-52	Advanced breeding line	Desi	12.15	8.35	10.25	MR
IPC 2005-24	Advanced breeding line	Desi	15.8	11.55	13.67	MR
IPC 2005-19	Advanced breeding line	Desi	9.25	8.1	8.67	R
IPC 2010-03	Advanced breeding line	Desi	3.4	12.45	7.92	R
IPC 2007-50	Advanced breeding line	Desi	17.9	19.25	18.57	MR
IPC 2011-76	Advanced breeding line	Desi	7.95	9.5	8.72	R
IPC 2011-28	Advanced breeding line	Desi	8.05	7.9	7.97	R
IPC 2010-173	Advanced breeding line	Desi	5.45	9.05	7.25	R
IPC 2012-03	Advanced breeding line	Desi	12.95	8.75	10.85	MR
IPC 2005-26	Advanced breeding line	Desi	11.9	9.7	10.8	MR
IPCK2012-48	Advanced breeding line	Desi	15.05	13.1	14.07	MR
IPC 2008-10	Advanced breeding line	Desi	12.75	16.25	14.5	MR
IPCK 2012-310	Advanced breeding line	Kabuli	17.15	10.65	13.9	MR
IPC 2010-185	Advanced breeding line	Desi	11.55	18.15	14.85	MR
IPC 2009-153	Advanced breeding line	Desi	6.85	9.7	8.27	R
IPC 2010-61	Advanced breeding line	Desi	11.1	16.95	14.02	MR
IPC 2012-198	Advanced breeding line	Desi	6.4	9.3	7.85	R
IPC 2012-99	Advanced breeding line	Desi	12.25	11.65	11.95	MR
IPC 2007-51	Advanced breeding line	Desi	11.8	8.85	10.32	MR
IPC 2010-152	Advanced breeding line	Desi	11.35	8.85	10.1	MR
IPC 2011-65	Advanced breeding line	Desi	14.55	13.05	13.8	MR
IPC 2010-128	Advanced breeding line	Desi	8.85	9.1	8.97	R
IPC 2010-120	Advanced breeding line	Desi	12.3	19	15.65	MR
IPC 2010-146	Advanced breeding line	Desi	14	20.05	17.02	MR
IPC 2010-121	Advanced breeding line	Desi	6.35	8.3	7.32	R
IPCK 2013-209	Advanced breeding line	Kabuli	4.4	9.35	6.87	R
IPC 2007-04	Advanced breeding line	Desi	5.05	5.1	5.07	R
WR-315	Released variety	Desi	4.15	5.9	5.02	R
IPCK 2012-258	Advanced breeding line	Kabuli	10.4	8.95	9.67	R
IPC 2007-36	Advanced breeding line	Desi	7.95	2.85	5.4	R
IPC 2010-78	Advanced breeding line	Desi	7.35	6.9	7.12	R
IPC 2011-94	Advanced breeding line	Desi	7.6	7.7	7.65	R
IPCK 2013-248	Advanced breeding line	Kabuli	8.65	9.5	9.07	R
IPC 2009-66	Advanced breeding line	Desi	1.05	3.8	2.42	R
IPC 2007-28	Advanced breeding line	Desi	3.55	8.9	6.22	R
C-104	Advanced breeding line	Desi	34.7	33.45	34.07	S
IPC 2010-207	Advanced breeding line	Desi	22.4	12.7	17.55	MR
IPCK 2012-306	Advanced breeding line	Kabuli	5.55	9.4	7.47	R
IPC 2011-31	Advanced breeding line	Desi	3.45	8.5	5.97	R
IPC 2011-45	Advanced breeding line	Desi	24.67	32.85	28.76	S
IPC 2011-258	Advanced breeding line	Desi	21.925	19.96	20.94	S

Contd.

Table 1 (*Concluded*)

Genotype	Status	Type	% FW incidence recorded in Year 2016	% FW incidence recorded in Year 2017	Mean	Disease reaction
IPC 2011-36	Advanced breeding line	Desi	5.375	5.95	5.66	R
IPC 2011-78	Advanced breeding line	Desi	15.44	10.75	13.0	MR
IPC 2011-248	Advanced breeding line	Desi	27.295	32.6	29.94	S
IPC 2011-15	Advanced breeding line	Desi	39.58	32.2	35.89	S
IPC 2011-66	Advanced breeding line	Desi	9.975	17	13.48	MR
IPC 2016-186	Advanced breeding line	Desi	5.9	9.6	7.75	R
IPC 2016-36	Advanced breeding line	Desi	6.1	9	7.55	R
IPC 2016-50	Advanced breeding line	Desi	6.95	11.11	9.03	R
IPC 2016-44	Advanced breeding line	Desi	7.45	11.1	9.27	R
IPC 2016-31	Advanced breeding line	Desi	12.45	17.86	15.15	MR
IPC 2016-74	Advanced breeding line	Desi	14.95	14.2	14.57	MR
IPC 2016-91	Advanced breeding line	Desi	4.65	8.7	6.67	R
IPC 2016-69	Advanced breeding line	Desi	4.3	7.69	5.99	R
IPC 2016-03	Advanced breeding line	Desi	4.6	7.98	6.29	R
IPC 2016-85	Advanced breeding line	Desi	5.7	7.93	6.81	R

R, resistant; MR, moderately resistant; S, susceptible;

check (JG 62) was planted after every two genotypes. FW disease incidence was recorded at pre-flowering, post flowering and post podding stages (from November to February). The disease incidence was scored according to the following method suggested by Dubey *et al.* (2010) and Sharma *et al.* (2016):

$$\% \text{ disease incidence} = \frac{\text{Number of FW infected plants} \times 100}{\text{Total number of plants}}$$

Based on the % disease incidence, genotypes displaying <10.0% incidence were classified as resistant, genotypes displaying 10.1–20.0% incidence were classified as moderately tolerant, whereas, genotypes showing 20.1–50.0% incidence were classified as moderately susceptible and genotypes showing >50.0% incidence were classified as susceptible. Of the 75 tested genotypes, a total of 31 genotypes revealed resistant reaction and 33 genotypes displayed MR reaction against FW, whereas rest of the 11 genotypes showed susceptible reaction for FW. Thus, the resistant lines exhibiting resistant reaction against FW could be potentially used as genetic stock for transferring FW resistance to elite high yielding chickpea cultivars.

SUMMARY

Fusarium wilt (FW) disease caused by *Fusarium oxysporum* f. sp. *ciceris* remains one of the major biotic stresses challenging chickpea production globally. Thus, to explore FW resistant chickpea genotypes; we tested a set of 75 advanced breeding lines including one FW susceptible check and one FW resistant check for two consecutive years 2016 and 2017 in FW (Foc2) infected sick plot. A total of 30 resistant lines, viz. IPC2005-45, IPC2005-19, IPC2010-03 and 34 moderately resistant, viz. IPC 2005-37, IPC 2004-08, IPC 2006-64 and 11 susceptible lines were identified based on the two year data. Thus, these identified resistant lines could be directly released for FW resistant variety or could serve as important donors for developing FW resistant chickpea cultivars.

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