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New sources of resistance against *fusarium oxysporum* f.sp. *Udum* causing wilt of pigeonpea

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Abstract
Fusarium wilt is a serious disease in pigeonpea, which causes severe yield losses. The *F. udum* is host specific to pigeonpea and can survive in soil under wilted plant stubble for a long period. The best way of wilt management is by growing resistant varieties. Out of 51 germplasm, screened twelve germplasm *viz*.; AL 1932, BRG 5, CRG 2013-10, GRG 82, GRGK 1, ICP 8863, ICPHL 4989-7, KA 12-3, PT 257, PT 307-1, WRG 293 and ICP 8863 were found resistant, 21 moderately resistant, 2 tolerant, 11 moderately susceptible and 5 germplasm *viz*.; AKT 12-1, AL 1933, ICP 2376, KA 12-2, BAHAR 6424 were highly susceptible to *Fusarium* wilt.

Keywords: Pigeonpea, *Fusarium*, germplasm, resistant

Introduction
Pigeonpea [*Cajanus cajan* (L) Mills.] is major pulse crop grown component of pulses grown in the tropics and subtropics and belongs to family leguminosae. It commonly known as Arhar, Tur, Redgram, Cangopea and Gandul, holds an important position in Indian subcontinent. It possesses high protein content and is consumed in the form of split pulse as dal. It is a *kharif* season crop that has wide adaptability and low input requirements. The heavy shedding of leaves adds considerable organic matter into the soil. Pigeonpea is the 4th ranked pulse crop in the world. In India, Pigeonpea is the 2nd most important pulse crop after chickpea. Besides India, it is also grown in South East Asia, Africa and America. In India, production of Pigeonpea was 42.54 Lac tones on area of 44.31 Lac ha with yield of 960 kg/ha (Anonymous, 2018) [1]. In India, the crop is mainly grown in Andhra Pradesh, Bihar, Uttar Pradesh, Karnataka, Gujarat, Madhya Pradesh, Maharashtra, Orissa and Tamilnadu. The poor yield of pigeonpea is mainly due to biotic stress like diseases and insect pests. The crop is infected by 210 pathogens (83 fungi, 4 bacteria, 19 viruses and mycoplasma and 104 nematodes) reported from 58 countries. The maximum number has been reported from India with 98 pathogens (Nene *et al.*, 1996) [7], but only few of them like wilt, sterility mosaic, phytophthora blight and Alternaria blight are major and destructive diseases. Among these, wilt disease caused by *Fusarium udum* is the most serious problem all over the Pigeonpea growing states especially in U.P., M.P., Bihar and Maharashtra. The *F. udum* is host specific to pigeonpea (Patel *et al*., 2011) [8] and can survive in soil under wilted plant stubble for a long period. In the epiphytotic conditions, disease incidence was recorded 15-25 per cent in general and up to 50 per cent (Butler, 1910) [3]. In Bihar and Uttar Pradesh, 5-10 per cent losses in standing crop are common feature every year (Singh, 2006) [11]. The best way of wilt management is by growing resistant varieties. For developing resistant varieties, resistant source are the basic requirements. Identification of resistant sources involves testing germplasm under heavy inoculum potential and under conditions conducive for maximum disease development. Sick plot technique has been reported for large scale screenings under field conditions and a sick soil technique (pot screening) for confirming resistance.

Materials and Methods
Seeds of fifty one germplasm of Pigeonpea were obtained from the Department of Genetics and Plant Breeding, N.D. University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) and IIPR, Kanpur. Entries were sown on the month of late june or early july in the uniform wilt plots with the onset of the man soon (rainy) season. The germplasm were screened under field condition (Sick plot technique) in RBD design with two replications using the methods described by Nene *et al*., (1982) [6]. After germination observations were recorded regularly up to 60 days for the appearance of wilt symptoms and severity. The number of

Wilted plants was counted during cropping periods and data converted into disease incidence. The disease was recorded using 1-9 scale for the wilt disease of Pigeonpea as described in Table 1.

Table 1: Disease rating scale for *Fusarium* wilt (Nene *et al*., 1981) [5].

S. No.	Scale	Description	Disease reaction
1.	1	No symptoms on any plant	Resistant
2.	3	10% or less mortality	Moderately
3.	5	11-20% mortality	Tolerant
4.	7	20-50% mortality	Moderately susceptible
5.	9	51% or more mortality	Susceptible

Results and Discussion

The results revealed that the 51 germplasm of Pigeonpea were screened for their reaction to *Fusarium udum* by sick plot technique. It is evident from the result presented in table 2 that the evaluated 51 germplasm, twelve germplasm *viz*.; AL 1932, BRG 5, CRG 2013-10, GRG 82, GRGK 1, ICP 8863, ICPHL 4989-7, KA 12-3, PT 257, PT 307-1, WRG 293 and ICP 8863 were found resistant, 21 moderately resistant, 2 tolerant, 11 moderately susceptible and 5 germplasm *viz*.; AKT 12-1, AL 1933, ICP 2376, KA 12-2 and BAHAR 6424 were highly susceptible to *Fusarium* wilt. The most susceptible variety Bahar showed 80 per cent wilting. Sharma *et al.*, (2012) [10] noticed that ICP 6739, ICP 8860, ICP 11015, ICP 13304, ICP 14638 and ICP 14819 were wilt resistant accessions after screening a pigeonpea mini-core collection. Jaggal *et al*., (2014) [4] observed that 39 accessions were resistant to wilt disease. Pawar *et al*., (2015) [9] reported that two germplasm lines *viz*., ICP-7088 and ICP-8863 were only wilt resistant. The similar results were also reported by Singh *et al.*, (2011) [12] and Bhaskar (2016) [2].

Table 2: Performance of Pigeonpea genotypes against *Fusarium udum* under field condition (Sick plot technique).

Disease rating scale	Reaction	Name of the genotypes
1	Resistant	AL1932, BRG5, CRG2013-10, GRG82, GRGK1, ICP8863, ICPHL4989-7, KA12-3, PT257, PT307-1, WRG293, ICP8863.
3	Moderately resistant	AKTE10-12, BRG14-1, BRG14-2, BSMR2, CRG2010-11, GRG140, GRG2009-1, GRG160, MAHABEU105, PG27R, SKN1205, TJT501, WRG280, WRG146, WRG252, WRG256, WRG285, WRG286, WRG297, WRG65, WRG97.
5	Tolerant	BAU13-1, BDN2004.
7	Moderately susceptible	BDN2010, IPA13-1, JSA28, PA419, PUSA2014, PUSA20142, RVSA07-29, RVSA0731, RVSA2014-2, RVSA07-10, RVSA07-22.
9	Highly susceptible	AKT12-1, AL1933, ICP2376, KA12-2, BAHAR6424.

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