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Screening of maize hybrids (*Zea mays* L.) against the severity of Turcicum leaf blight

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Abstract
Maize (*Zea mays* L.) is an important cereal and fodder crop cultivated across the world (White and Johnson, 2003). It belongs to tribe Maydeae of the family Poaceae. Maize plants are faced with numerous biotic stresses and adverse environmental conditions. Turcicum or Northern corn leaf blight (NCLB) is a serious foliar disease of maize in many tropical and temperate environments .It is a severe disease caused by fungus resulting into yield losses worldwide and is most effectively controlled by resistant varieties. The disease caused development of lesions on leaf surfaces which hampered the photosynthetic processes and thus yield decreases. This experiment was carried out in order to identify the reaction of developed maize hybrids to turcicum leaf blight pathogen under field conditions in randomised block design with three replications. Scoring of infected leaves were based on nine broad categories designated by numerals 1 to 9 (Chung *et al*., 2010 and Mitiku *et al*., 2014). After disease scoring PDI was arcsin transformed and analysis was done. Among thirty selected hybrids 3 were found resistant, 10 as moderately susceptible and 17 as moderately resistant.

Keywords: Turcicum leaf blight, resistance, infection, PDI

Introduction
Maize (*Zea mays* L.) is an important cereal and fodder crop cultivated across the world (White and Johnson, 2003) [16]. It belongs to tribe Maydeae of the family Poaceae. Maize plants are faced with numerous biotic stresses and adverse environmental conditions. Biotic stresses are caused by pests, parasites and pathogens, which are known since ancient times. Among the biotic stresses Turcicum Leaf blight (TLB) of maize caused by *Exserohilum turcicum* (Pass.) K.J. Leonard and E.G. Suggs (teleomorph *Setosphaeria turcica* Luttrell) was first observed by Passerini on maize in Italy in 1876, and has been reported from all maize growing areas of the world wherever maize is cultivated (Atac. 1984; Leonard et al., 1985) [1]. The disease was reported as early as 1923 in India and assumed as an epiphytotic form in Kashmir valley (Koul, 1957) [6]. Turcicum or Northern corn leaf blight (NCLB) is a serious foliar wilt disease of maize in many tropical and temperate environments. It is a severe disease caused by fungus resulting into yield losses worldwide and is most effectively controlled by resistant varieties. Symptoms can range from small cigar shaped lesions to complete destruction of the foliage (Welz and Reiger, 2000) [14]. The favorable condition for disease is high humidity with high temperatures from three leaf stages to grain development of crop (Palaversic *et al*., 2012) [9]. In mid-altitude regions where there is high humidity, low temperature and cloudy weather TLB can be severe during the maize growing season (Singh *et al*., 2004; Harlapur, 2005) [15, 9]. Turcicum leaf blight causes extensive defoliation during grain filling period, reduces succulence of leaves and stalk necrosis resulting in grain yield losses (Perkins and Pederson, 1987) [10]. As the disease develops, the lesions spread to all leafy structures, including the husks, and produce dark gray spores, giving lesions as dirty appearance. The lesions may become so numerous that the leaves are eventually destroyed, causing major yield loss due to reduction in the available of carbohydrates to fill the grain. This experiment was carried out in order to identify the reaction of developed maize hybrids to Turcicum leaf blight pathogen under field conditions.

Materials and Methods
The material for study was developed by crossing the productive lines with three different testers. The experiment was conducted during kharif 2019 at the Research farm of Birsa Agricultural University, Ranchi.

The experiment was laid out in randomised block design with three replications. The crop was grown by following recommended agronomic practices as per the package of practices. Artificial inoculation of the pathogen was also done to increase the disease pressure and the observations on disease severity was recorded followed by categorization of genotypes as resistant, moderately resistant, susceptible and highly susceptible The hybrids thus obtained were screened for turcicum leaf blight.

Scoring of infected leaves were based on 9 broad categories designated by numerals 1 to 9 (Chung *et al*., 2010 and Mitiku *et al*., 2014) [4, 8] as below.

1. Nil to very slight infection (≤ 10%);
2. Slight infection, a few lesions scattered on two lower leaves (10.1- 20%);
3. Light infection, moderate number of lesions scattered on four lower leaves (20.1-30%);
4. Light infection, moderate number of lesions scattered on lower leaves, few lesions scattered on middle leaves below the cob (30.1 – 40%);
5. Moderate infection, abundant number of lesions scattered on lower leaves, moderate number of lesions scattered on middle leaves below the cob (40.1 – 50%);
6. Heavy infection, abundant number of lesions scattered on lower leaves, moderate infection on middle leaves and a few lesions on two leaves above the cob (50.1 – 60%);
7. Heavy infection, abundant number of lesions scattered on lower and middle leaves and moderate number of lesions on two to four leaves above the cob (60.1 – 70%);
8. Very heavy infection, lesions abundant scattered on lower and middle leaves and spreading up to flag leaf (70.1 – 80%);
9. Very heavy infection, lesions abundant scattered on almost all the leaves, plant prematurely dried and killed (> 80%).

Severity scores were converted to per cent disease index (PDI) as described by Wheeler (1969) using the formula below;

PDI = (Sum of all numerical grading x 100)/No. of Leaves examined

The PDI values were then arcsine transformed and subjected for Analysis of Variance.

Results

Incidence of disease was assessed as the proportion of plants showing symptoms in the field. PDI of hybrids are presented in table 1.

Table 1: The hybrids and PDI mean

		PDI			
S. No.	**Hybrids**	**R1**	**R2**	**R3**	**Mean**
1	BAU-15-255 XHKI1532	62.67	50.12	59.22	57.34
2	BAU-15-71 XHKI1532	66.67	51.67	63.28	60.54
3	52216 XHKI1532	73.33	52.67	69.92	65.31
4	BAU-15-145 XHKI1532	50.98	61.28	67.87	60.04
5	BAU-15-102 XHKI1532	72	49.33	68.62	63.32
6	BAU-15-180 X HKI1532	69.33	57.59	65.88	64.27
7	BAU-15-78 -1 X HKI1532	70.67	54.67	66.98	64.11
8	BAU-15-122 X HKI1532	73.33	64.27	54.67	64.09
9	BAU-15-87 X HKI1532	50.98	66.49	70.69	62.72
10	BAU-15-178 X HKI1532	65.33	48.27	61.39	58.33
11	BAU-15-255 X Suwan	46.67	36.61	43.47	42.25
12	BAU-15-71 X Suwan	52	42.28	48.96	47.75
13	52216 X Suwan	48	31.42	45.02	41.48
14	BAU-15-145 X Suwan	50.67	45.62	47.46	47.92
15	BAU-15-102 X Suwan	45.33	34.44	42.03	40.60
16	BAU-15-180 X Suwan	32	25.56	28.79	28.78
17	BAU-15-78 -1 X Suwan	54.67	46.75	50.98	50.80
18	BAU-15-122 X Suwan	46.67	34.64	43.02	41.44
19	BAU-15-87 X Suwan	36	26.48	32.96	31.81
20	BAU-15-178 X Suwan	29.33	38.67	25.51	31.17
21	BAU-15-255 XHKI 577	41.33	52	38.08	43.80
22	BAU-15-71 XHKI 577	42.67	35.62	38.48	38.92
23	52216 XHKI 577	38.67	31.42	35.21	35.10
24	BAU-15-145 XHKI 577	45.33	35.55	41.64	40.84
25	BAU-15-102 XHKI 577	49.33	38.54	45.56	44.48
26	BAU-15-180 X HKI 577	46.67	38.54	42.61	42.61
27	BAU-15-78 -1 X HKI 577	38.67	31.38	48	39.35
28	BAU-15-122 X HKI 577	44	35.62	40.87	40.16
29	BAU-15-87 X HKI 577	49.33	38.67	45	44.33
30	BAU-15-178 X HKI 577	48	43.11	53.64	48.25

Transformation of data by arc sine method (Steel and Torrie, 1980) was done and analyses of variance in transformed data are presented in table 2.

Table 2: Show the different of replication and treatment

Source	D.F.	S.S	M.S.	F-Cal	Significance
Replications	2	371.25			
Treatment	29	3745.87	129.17	12.12	0.000000
Error	58	618.33	10.66		
Total	89	4735.44			

SEM	1.885
Sed	2.666
CD@5%	5.35
CV	7.444

The hybrids were grouped into three categories based on their Percent disease index (PDI%) as resistant (R), moderately resistant (MR) and moderately susceptible (MS) is presented in table 3.

Table 3: Show the Hybrids and Reaction

S. No.	Hybrids	Reaction	S. No.	Hybrids	Reaction
1	BAU-15-255 XHKI1532	MS	16	BAU-15-180 X Suwan	R
2	BAU-15-71 XHKI1532	MS	17	BAU-15-78 -1 X Suwan	MR
3	52216 XHKI1532	MS	18	BAU-15-122 X Suwan	MR
4	BAU-15-145 XHKI1532	MS	19	BAU-15-87 X Suwan	R
5	BAU-15-102 XHKI1532	MS	20	BAU-15-178 X Suwan	R
6	BAU-15-180 X HKI1532	MS	21	BAU-15-255 XHKI 577	MR
7	BAU-15-78 -1 X HKI1532	MS	22	BAU-15-71 XHKI 577	MR
8	BAU-15-122 X HKI1532	MS	23	52216 XHKI 577	MR
9	BAU-15-87 X HKI1532	MS	24	BAU-15-145 XHKI 577	MR
10	BAU-15-178 X HKI1532	MS	25	BAU-15-102 XHKI 577	MR
11	BAU-15-255 X Suwan	MR	26	BAU-15-180 X HKI 577	MR
12	BAU-15-71 X Suwan	MR	27	BAU-15-78 -1 X HKI 577	MR
13	52216 X Suwan	MR	28	BAU-15-122 X HKI 577	MR
14	BAU-15-145 X Suwan	MR	29	BAU-15-87 X HKI 577	MR
15	BAU-15-102 X Suwan	MR	30	BAU-15-178 X HKI 577	MR

R=Resistant, MR=Moderately Resistant and MS=Moderately Susceptible.

The resistance reaction was found to be different among the hybrids. Among thirty selected hybrids 3(BAU-15-180 X Suwan, BAU-15-87 X Suwan and BAU-15-178 X Suwan) were found resistant ,10 (BAU-15-255 XHKI1532, BAU-15-71 XHKI1532, 52216 XHKI1532, BAU-15-145 XHKI1532, BAU-15-102 XHKI1532, BAU-15-180 X HKI1532, BAU-15-78 -1 X HKI1532, BAU-15-122 X HKI1532, BAU-15-87 X HKI1532 and BAU-15-178 X HKI1532) as moderately susceptible and 17 (BAU-15-255 X Suwan, BAU-15-71 X Suwan, 52216 X Suwan, BAU-15-145 X Suwan, BAU-15-102 X Suwan, BAU-15-178 X HKI 577, BAU-15-87 X HKI 577, BAU-15-122 X HKI 577, BAU-15-78 -1 X HKI 577, BAU-15-180 X HKI 577, BAU-15-102 XHKI 577, BAU-15-145 XHKI 577, 52216 XHKI 577, BAU-15-71 XHKI 577, BAU-15-255 XHKI 577, BAU-15-122 X Suwan and BAU-15-78 -1 X Suwan) as moderately resistant.

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