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Screening of Inbred Lines of *Rabi* Maize for *Turcicum* Leaf Blight (TLB) and *Maydis* Leaf Mlight (MLB) in Bihar

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ABSTRACT

Turcicum leaf blight and Maydis leaf blight are the two most devastating diseases of *rabi* maize causing huge amount of yield loss in Bihar and entire part of the nation. So, development of resistant maize variety against these two diseases is very much needful. Screening of inbred lines against these two diseases is the demand for development of such resistant varieties using conventional or molecular breeding methods. Concerning this, a field experiment was designed to screen the resistant inbred lines of *rabi* maize. Total 29 inbred lines were considered in this study which was conducted at research farm of TCA, Dholi, Bihar for consecutive three years (2017 – 20). From this study, it was observed that among 29 inbred lines, 2 inbred lines, Dholi inbred – 2011 and 2015 were shown resistance to both the diseases during all three years of study. Other three inbred lines of Dholi centre viz. Dholi inbred – 2031, 2035 and 2038 were also shown resistance in initial year of study.

Keywords: Inbred line, maize, maydis leaf blight, *Turcicum* leaf blight

Maize (*Zea mays* L.) is considered as the 'queen of cereals' and it is one of the most important crops in the world providing food for human beings and feed as well as fodder for livestock (Ghosh *et al.* 2020). It is a staple food for several million people in the developing world where they derive their protein and calorie requirements from it. Maize is widely cultivated in India and *rabi* (winter) maize is very much popular in the states like Bihar, Andhra Pradesh etc. (Timsina *et al.* 2010). Although, improved cultivars have been largely included in the national extension package, the national average yield of maize is low, which is below the world average. The low yield is attributed to a number of factors such as biotic (diseases, insect pests, and weeds), abiotic (moisture, soil fertility, etc). Among biotic factors, foliar diseases such as TLB i.e. turcicum leaf blight (*Exserohilum trurcicum*) and MLB i.e. maydis leaf blight (*Cochliobolus heterostrophus*) are generally among the important constraints in tropical maize production. Previously the disease was limited to specific areas and varieties, but currently the disease become very important almost in all maize growing agro-ecologies due to climate change and pathogens virulent and/or avirulent shifts. TLB and MLB can be effectively controlled by growing resistant varieties. More farmers need to adopt resistant maize varieties in order to withstand future TLB and MLB outbreaks in Bihar. Genetic resistance is the safest and best control strategy for resource-poor farmers in addition to being

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profitable option for farmers that can multiply seed (DRRW, 2010). Thus, the objective of this study was to evaluate the reaction of maize inbred lines against TLB and MLB under field conditions with artificial inoculation.

MATERIALS AND METHODS

The experiment was conducted for three consecutive years of 2017–18, 2018–19 and 2019–20 at research farm of Tirhut College of Agriculture, Dholi, Bihar. 29 Maize inbred lines were evaluated against TLB and MLB diseases. The treatment was arranged following a randomized complete block design (RCBD) with three replications for two disease types, separately. The plots were ploughed with tractor and disc harrowed twice before planting. The distance between rows and plants were 60 cm and 15 cm, respectively. All plots were planted by hand with two seeds per hole. Inorganic fertilizer (DAP, Urea and MOP) and all agronomic practices were applied based on the area recommendations.

The TLB and MLB pathogens were isolated by collecting diseased maize leaf lesions and placing in a moist chamber. After two-three days newly formed spores on the surface of the lesions was picked up with the help of fine flattened needle under a dissecting microscope placed in a droplet of sterile water and streak across the surface hardened, acidified water agar in petriplates. After 6 h the spores start to germinate, and it was cut out of the agar and transferred to hard, acidified PDA. After two weeks of incubation at 20–25 ^{o}C, this culture was transferred to fresh plates of acidified PDA for multiplication. When the fungus growth was covered the surface of petri-plate fully, the cultures were ready for use. The spores suspension at 60,000 spores ml^{-1} was applied in the whorl using atomizer hand sprayers. Inoculation was made twice a week for three weeks, when plants were 30–45 cm high.

Disease severity estimation of maize inbred lines were phenotyped for TLB and MLB severity when the diseases are appeared using standard 1–5 scale, 1 being complete resistant and 5 being the complete susceptible (Payak and Sharma, 1982). Based on this rating scale over three years, maize inbred lines were categorized into four groups namely, resistant (R) genotypes with a score < 2.0; moderately resistant (MR) 2.1–3.0; moderately susceptible (MS) 3.1–3.5 and highly susceptible (S) > 3.5.

Analysis of variance (ANOVA) was used for disease data as randomized block design (RCBD) and following the procedure described by Gomez and Gomez (1984), using SAS computer software. Mean separation was done based on LSD at 5% probability level. Disease data were analysed after checking good fitness to ANOVA.

RESULTS AND DISCUSSION

Among 29 tested inbred lines of maize, totally 5 lines viz. Dholi inbred – 2011, 2015, 2031 and 2038 were showed resistant responses for *Turcicum* leaf blight during 2017 – 18, while, in second year Dholi inbred – 2011, 2015, 2031 and 2035 were shown resistant and in 2019 – 20, only Dholi inbred – 2011 and 2015 were resistant to TLB disease (Table 1). The number of moderately resistant inbred lines were 15 during first and second years of assessment, while, the number was decreased to 13 during 2019 – 20. On the other hand, the numbers of moderately susceptible inbred line numbers were 9, 10 and 13 during 2017 – 18, 2018 – 19 and 2019 – 20, respectively. Local check line, CML – 186, showed susceptible during all three years of study. Overall, it was found that the inbred lines, Dholi inbred – 2011 and 2015 were resistant to the TLB disease for all three years of study.

Concerning the assessment of maydis leaf blight disease of maize inbred lines, it was observed that out of 29 inbred lines, 2 inbred lines, Dholi inbred – 2011 and 2015 showed resistant to MLB disease during all the years of study, while, inbred line, Dholi inbred – 2031 showed resistance to this disease during 1st and 2nd year of assessment (Table 2). Overall, 12 inbred lines *viz*. Dholi Inbred – 2031, S99 TLYQHGA 84-26 B.B.B, CML-470-B4/AMDROUTI (AC) C_1F-18-B4, DML – 1018, DML – 2055, DML – 2017, DML – 2036, Dholi inbred – 2035, Dholi inbred – 2038, DQL – 614-4, DMRQPM 121, UMI – 1205, were showed moderately resistant reaction against maydis leaf blight. Remaining inbred lines showed moderately susceptible reaction. Susceptible check CML 186 showed moderately susceptible reaction during 2017 – 18 and 2018 – 19, while this line was shown susceptible reaction during 2019 – 20. All these results are corroborated with the results previously recorded by Hailu *et al.* (2018).

Table 1: Screening of inbred lines against *Turcicum* leaf blight during *Rabi* 2017 – 18, 2018 – 19 and 2019 – 20

Inbred lines	Mean Disease score			Disease Reaction		
	2017 – 18	2018 – 19	2019 – 20	2017 – 18	2018 – 19	2019 – 20
Dholi Inbred-2011	1.9	2.6	2.0	R	R	R
Dholi Inbred-2015	2.6	2.6	2.8	R	R	R
Dholi Inbred-2031	2.8	2.8	3.2	R	R	MR
S_{99} TLYQHGA 84-26 B.B.B	4.0	4.5	4.3	MR	MR	MR
DQL-2241	4.8	4.9	5.3	MR	MR	MS
DQL-2304	5.0	4.5	5.6	MR	MR	MS
CML-470-B_4/AMDROUTI (AC) C_1F-18-B_4	4.4	4.0	5.6	MR	MR	MS
MARSSSYN-155 -2-1-1-BB	4.2	6.5	3.6	MR	MS	MR
DML – 1846 (BM2-11)	5.7	4.9	6.0	MS	MR	MS
DML – 1018	3.9	3.9	4.2	MR	MR	MR
DML – 117	5.2	5.5	6.0	MS	MS	MS
DML – 1828	6.1	4.7	6.2	MS	MR	MS
DML – 2055	3.6	3.8	4.0	MR	MR	MR
DML – 2017	3.8	4.0	4.0	MR	MR	MR
DML – 2036	4.1	5.2	4.2	MR	MS	MR
CAL-14135	4.4	5.1	4.6	MR	MS	MR
IMLSB -46-1	6.2	4.0	6.2	MS	MR	MS
IMLSB -106 -1	6.4	6.2	6.7	MS	MS	MS
Dholi inbred- 2035	3.8	2.9	4.3	MR	R	MR
Dholi inbred- 2038	3.0	4.0	3.6	R	MR	MR
IMLSB -282-2	5.8	5.7	6.0	MS	MS	MS
IMLSB -451-2	6.8	5.8	6.8	MS	MS	MS
IMLSB -561-2	5.4	4.4	5.6	MS	MR	MS
P_{72}XBrasil 117	4.8	6.0	5.2	MR	MS	MS
DQL -614-4	4.0	5.0	4.2	MR	MR	MR
DMRQPM 121	3.6	3.8	4.4	MR	MR	MR
UMI -1200	5.9	5.5	6.2	MS	MS	MS
UMI -1205	4.2	4.1	4.2	MR	MR	MR
S. Ch. (CML 186)	7.1	7.0	7.1	S	MS	S

R, MR, MS, S denote resistant, moderately resistant, moderately susceptible and susceptible, respectively.

Table 2: Screening of inbred lines against Maydis leaf blight during *Rabi* 2017 – 18, 2018 – 19 and 2019 – 20

Inbred lines	Mean Disease score			Disease Reaction		
	2017 – 18	2018 – 19	2019 – 20	2017 – 18	2018 – 19	2019 – 20
Dholi Inbred-2011	3.0	3.0	2.7	R	R	R
Dholi Inbred-2015	2.7	3.0	3.0	R	R	R
Dholi Inbred-2031	2.9	2.9	3.9	R	R	MR
S_{99} TLYQHGA 84-26 B.B.B	4.4	4.7	4.9	MR	MR	MR
DQL-2241	5.0	5.6	5.9	MR	MS	MS
DQL-2304	5.7	4.6	6.0	MS	MR	MS
CML-470-B_4/AMDROUTI (AC) C_1F-18-B_4	4.3	4.2	5.3	MR	MR	MS
MARSSSYN-155 -2-1-1-BB	4.6	6.5	4.1	MR	MS	MR
DML – 1846 (BM2-11)	6.2	5.0	6.0	MS	MR	MS
DML – 1018	4.2	4.6	4.7	MR	MR	MR
DML – 117	5.7	6.0	5.7	MS	MS	MS
DML – 1828	5.9	5.6	6.3	MS	MS	MS
DML – 2055	3.7	4.5	3.4	MR	MR	MR

DML – 2017	3.9	4.8	4.4	MR	MR	MR
DML – 2036	4.3	5.9	4.9	MR	MS	MR
CAL-14135	4.3	5.5	5.1	MR	MS	MS
IMLSB -46-1	6.6	5.8	6.3	MS	MS	MS
IMLSB -106 -1	6.4	6.2	6.7	MS	MS	MS
Dholi inbred- 2035	4.5	4.3	4.8	MR	MR	MR
Dholi inbred- 2038	3.4	4.4	4.5	MR	MR	MR
IMLSB -282-2	6.0	6.6	6.1	MS	MS	MS
IMLSB -451-2	6.8	5.7	6.6	MS	MS	MS
IMLSB -561-2	5.7	4.5	5.9	MS	MR	MS
P_{72}XBrasil 117	4.9	6.0	5.1	MR	MS	MS
DQL -614-4	4.4	5.9	4.7	MR	MS	MR
DMRQPM 121	4.6	4.3	4.5	MR	MR	MR
UMI -1200	6.2	6.0	5.7	MS	MS	MS
UMI -1205	4.6	4.1	4.5	MR	MR	MR
S. Ch. (CML 186)	6.9	6.9	7.1	MS	MS	S

R, MR, MS, S denote resistant, moderately resistant, moderately susceptible and susceptible, respectively.

CONCLUSION

TLB and MLB are two major diseases of maize in Bihar as well as India. Screening was done at Dholi centre for three consecutive years to identify the best inbred lines of maize lines for these two diseases. Total 29 inbred lines were screened including a susceptible check CML – 186. Among these 29 inbred lines, 2 inbred lines, Dholi inbred – 2011 and 2015 were shown resistance to both the diseases during all three years of study. Other three inbred lines of Dholi centre viz. Dholi inbred – 2031, 2035 and 2038 were also shown resistance in initial year of study. However, they are found moderately resistant concerning three years of study. Therefore, attention should be given for both these inbred lines to develop resistant maize varieties for maize in future. This selected resistance maize inbred line from this screening should be used in breeding program and finding of resistant maize lines for both diseases will be continued using conventional and molecular methods.

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