Biological Forum – An International Journal **14(3): 1414-1418(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Cross Infectivity Studies of Turcicum Leaf Blight Pathogen (*Exserohilum turcicum*) under Green House conditions

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(Received 11 July 2022, Accepted 23 August, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: An experiment was conducted at Agricultural College, Bapatla during 2021-2022. Twelve maize and 12 sorghum *E. turcicum* isolates were collected from the Guntur, Prakasam and Bapatla districts. The spore suspension of all the 12 maize *E. turcicum* isolates were cross inoculated on sorghum plants and similarly, the spore suspension of all the 12 sorghum *E. turcicum* isolates was cross inoculated on maize plants. When the results were observed all the maize isolates infected the sorghum plants and all the sorghum *E. turcicum* isolates infected the maize plants. There was a significant difference among the treatments in terms of incubation period, lesion length and per cent disease index. Among the maize isolates the Bapatla isolate BPT-1 showed the minimum incubation period (24 h), maximum lesion length (11.13 cm) and the highest PDI (22.5%) when cross inoculated on sorghum plants. When the response was observed among the sorghum isolates on maize plants, the Guntur isolate RDG showed the minimum incubation period (24 h), maximum lesion length (11.20 cm) and the highest PDI (25.30%).

Keywords: Cross infectivity, *Exserohilum turcicum*, Maize, Sorghum, Turcicum leaf blight.

INTRODUCTION

Maize (*Zea mays* L.), a C_4 grass belonging to the family Poaceae, popularly known as "corn" is one of the most versatile emerging cash crops having wider adaptability under varied climatic conditions. Due to its highest genetic yield potential, globally maize is called the "Queen of cereals". It was reported that the present cultivable form of maize is the derivation from the mutation of wild form of pod maize, indigenous to the eastern slopes of Andus in South America which is thought to the place of its origin (Mangelsdorf, 1947).

Turcicum leaf blight of maize (*Zea mays*), also known as northern corn leaf blight causedby *Exserohilum turcicum*, is a widespread disease of maize, which can cause yield losses up to 70% (Yeshitila, 2003). Apart from yield loss, the disease causes qualitative changes in the seed resulting in decreased sugar content, germination capacity and severely infected plants are predisposed to stalk rot (Cardwell *et al*., 1997).

The pathogen was reported to have wide host range infecting crop species (Sarithunya *et al*., 2006), like sorghum, barley, oat, rice, millets, Sudan grass, Johnson grass, tobacco and sugarcane (Frederiksen and Franklin 1980; Shurleff, 2012). The pathogen was reported to perpetuate in these hosts in absence of maize (Acharya and Sengupta 2008). The maize pathogen has the ability to infect sorghum plants and the sorghum pathogen has the ability to infect maize crop (Rasmussen *et al*., 2003). The present investigation was carried out for the study of cross infectivity of *E. turcicum* infecting maize and sorghum.

MATERIALS AND METHODS

Experimental design. Cross infectivity studies among 12 maize isolates and 12 sorghum isolates were tested by challenge inoculating maize *E. turcicum* isolates on sorghum plants and the sorghum *E. turcicum* isolates on the maize plants under greenhouse conditions. The seeds (maize-Pioneer-3396, sorghum-NTJ-5) were

sown in black poly bags of 12" × 12". The bags were watered regularly. Two plants per bag were raised and three such bags for each isolate were considered as three replicates.

Inoculum preparation. Pure cultures of respective isolates were grown over PDA. Conidia from 12 days old culture was dislodged by flooding the plate with distilled water followed by gentle scraping. Slow growing isolates were mass multiplied on sorghum grains (inoculated with spore suspension) followed by stirring in sterile distilled water. The spore suspension was harvested in to a beaker and strained through muslin cloth. Tween-20 @ 0.1% was added to spore suspension before inoculation to ensure uniform spread of inoculum over leaves. The spore suspension adjusted to 10^5 spores per ml using haemocytometer was inoculated using hand sprayer @15ml/ plant during evening hours. Sorghum *E. turcicum* spore suspension was sprayed on maize plants and maize *E. turcicum* spore suspension was sprayed on sorghum plants. The plants sprayed with sterile distilled water + Tween-20 (0.1%) served as control.

Observations and data analysis. Immediately after spraying, the plants were covered with poly propylene covers for 24 h to prevent cross contamination and to ensure humidity for pathogen establishment. Incubation period (time required for first appearance of chlorotic or necrotic symptoms) for isolate was assessed by examining inoculated plants every day for appearance of lesion. Observations for disease severity were recorded 20 days after inoculation following standard scale. For sorghum standard 1-9 scale (Thakur *et al.*, 2007) and for maize standard 0-5 scale (CIMMYT, 2004). Based on disease severity PDI was calculated.

RESULTS AND DISCUSSION

Response of Maize *E. turcicum* isolates on Sorghum Plants when cross inoculated. The spore suspension of all the 12 maize *E. turcicum* isolates were cross inoculated on sorghum plants and similarly, the spore suspension of all the 12 sorghum *E. turcicum* isolates was cross inoculated on maize plants. When the results were observed in terms of incubation period, lesion length and per cent disease index there was a significant difference among the treatments. The results were depicted in the Tables 1 and 2.

When the response was observed on sorghum plants when cross inoculated with the maize *E. turcicum* isolates on 20 DAI, all the isolates differ significantly. The data was taken on the incubation period, lesion length and PDI.

Incubation period: When incubation period was observed on 20 DAI, the shortest incubation period was observed in BPT 1 (24 h), BPT 2 (24 h) which was statistically on par with other isolates *viz.*, CBL 1 (25.33 h), APK 1 (26.33 h) and CBL 2 (26.67 h). The longest incubation period was observed in LAM 1 isolate (37.67 h) which was on par with LAM 2 (36 h) and TNL 1 (36 h) (Table 1).

Lesion length: There is a significant variation in lesion formation on the leaves of sorghum (NTJ-5 variety) plants when cross inoculated with maize *E. turcicum* isolates. The maximum lesion length was observed in BPT 1 isolate (11.13 cm) which had lowest incubation period and highest PDI. The isolates with lesion length of BPT 2 (10.83 cm), APK 2 (8.67 cm) and APK 1 (8.28 cm) were statistically not significant with each other whereas, the lowest lesion length was observed in LAM 1 (1.46 cm) which also had longest incubation period and lowest PDI (Plate 1).

Per cent Disease Index (PDI): The PDI varied from 2.75% (LAM 1) to 22.5% (BPT 1). The isolate BPT 1 caused the highest PDI (22.5%) on the sorghum plants which was on par with another Bapatla isolate BPT 2 (21.64%). While the lowest PDI was observed in LAM 1 isolate (2.75%) which had longest incubation period. It was on par with three isolates *viz.*, LAM 2 (2.91%), TNL 2 (3.17%) and TNL 1 (3.25%). The isolates which showed the highest PDI have shortest incubation period and highest lesion lengths (Plate 1).

All the tested maize *E. turcicum* isolates were capable of causing the disease on the sorghum plants but the incubation period, lesion length and PDI varied significantly among the isolates.

Response of Sorghum Isolates on Maize Plants When Cross Inoculated. All the sorghum *E. turcicum* isolates were tested on the maize (Pioneer 3396 hybrid) plants. When the results were noted, there is a significant variation in terms of incubation period, lesion length and PDI among the isolates.

Incubation period: When all the sorghum isolates were tested, the shortest incubation period was observed in the Guntur isolate RDG (24 h) which varied significantly among all the isolates, followed by Bapatla isolate BPT (26 h) and Prakasam district isolate KTP (26 h). The longest incubation period was observed in KMR isolate (37 h). All the isolates varied significantly when tested on maize plants (Table 2).

Lesion length: The lesions formed on the leaves of maize plants significantly differed among the isolates. Highest lesion length was observed in RDG isolate (11.20 cm) which was statistically on par with Prakasam isolate SMG (10.4 cm). The lowest lesion length was observed in KMR isolate (1.68 cm) which had longest incubation period and lowest PDI and was on par with another isolate ELC (1.78 cm) (Plate 2).

Per cent Disease Index (PDI): When the PDI was observed, the highest PDI was observed in RDG (25.3%) which was on par with KTP (24.6%), EDM (24%) and BPT (24%). The lowest PDI was observed in KMR (4.16%) which has lowest lesion length and longest incubation period and was on par with ELC (4.25%) (Plate 2).

All the tested sorghum *E. turcicum* isolates were also capable of causing the disease on the maize plants but the incubation period, lesion length and PDI varied significantly among the isolates. The PDI was comparatively high in maize plants when inoculated

with sorghum *E. turcicum* isolates than the PDI on sorghum plants when inoculated with the maize *E. turcicum* isolates.

The results were in accordance with Masias and Bergquist (1974); Rasmussen *et al*. (2003) who reported that maize *E. turcicum* isolates infected sorghum crop and sorghum *E. turcicum* infected maize crop. Shankerlingam and Balasubramanian (1984) reported successful infection of sorghum isolates on maize. All the maize and sorghum plants tested were susceptible to the *E. turcicum* pathogen while incubation period, lesion length and PDI varied among the treatments (Serrone and Fornasari 1995).

Table 1: Response of maize isolates on sorghum plants when cross inoculated.

S. No.	Isolates	Incubation period (Hours)	Lesion length (cm) (20 DAI)	PDI (%)
			Mean	
1.	APK 1	26.33 (5.22)^{def}	8.28 (3.03)^{a}	15.06(4.03)^{b}
2.	APK 2	28.00 (5.38)^{de}	8.67 (3.10)^{a}	13.83(3.84)^{bc}
3.	CBL 1	25.33 (5.12)^{ef}	3.83 (2.16)^{b}	10.67(3.41)^{cd}
4.	CBL2	26.67 (5.25)^{def}	3.67 (2.13)^{b}	9.58 (3.25)^{d}
5.	BPT 1	24.00 (4.99)^{f}	11.13 (3.48)^{a}	22.25 (4.81)^{a}
6.	BPT 2	24.00 (4.99)^{f}	10.83 (3.43)^{a}	21.64 (4.75)^{a}
7.	LAM 1	37.67 (6.21)^{a}	1.46 (1.54)^{b}	2.75 (1.88)^{e}
8.	LAM 2	36.00 (6.08)^{ab}	1.67 (1.61)^{b}	2.91 (1.96)^{e}
9.	PNR 1	32.33 (5.77)^{bc}	2.56 (1.85)^{b}	8.65(3.09)^{d}
10.	PNR 2	28.67 (5.44)^{cde}	2.19 (1.74)^{b}	8.18(3.02)^{d}
11.	TNL1	36.00 (6.08)^{ab}	1.72 (1.59)^{b}	3.25(2.02)^{e}
12.	TNL 2	29.33 (5.50)^{cd}	1.78 (1.64)^{b}	3.17(2.03)^{e}
SEm±		0.118	0.210	0.183
CD (P≤0.05)		0.346	0.613	0.534
CV (%)		3.735	15.981	9.989

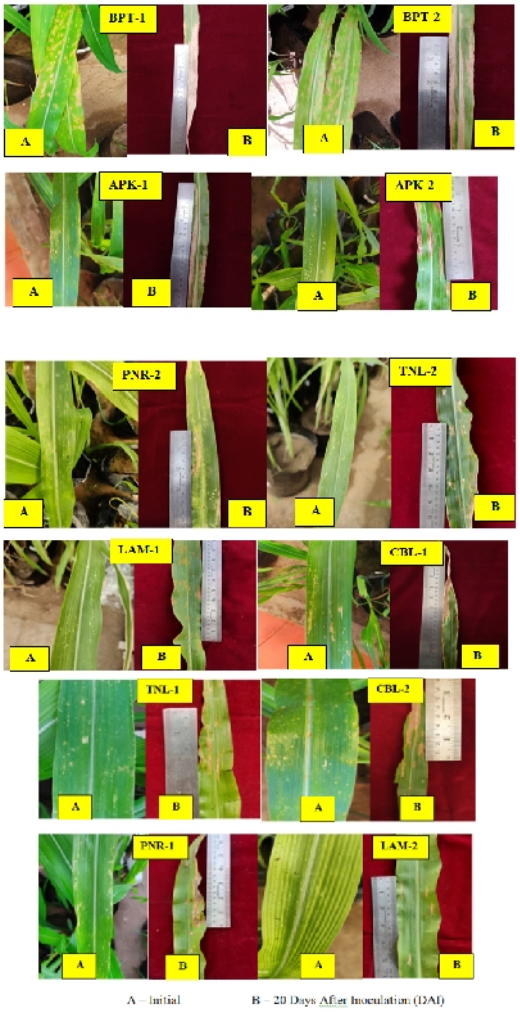

Plate 1. Response of maize isolates on sorghum plants when cross inoculated.

Table 2: Response of sorghum isolates on maize plants when cross inoculated.

S. No.	Isolates	Incubation period (Hours)	Lesion length (cm) (20 DAI)	PDI (%)
			Mean	Mean
1.	BPT	26.00 (5.19) [f]	8.28 (3.03) [b]	24.00 (5.00) [a]
2.	DVT	32.70 (5.80) [cd]	2.91 (1.97) [ef]	10.70(3.41) [f]
3.	IRP	28.00 (5.38) [e]	5.65 (2.56) [c]	19.80(4.56) [c]
4.	BVM	34.70 (5.97) [bc]	2.60 (1.88) [f]	10.90 (3.45) [f]
5.	RJP	32.30 (5.77) [d]	3.79 (2.15) [de]	16.80 (4.21) [d]
6.	RDG	24.00 (5.00) [g]	11.20 (3.48) [a]	25.30 (5.13) [a]
7.	SMG	27.30 (5.32) [e]	10.40 (3.37) [a]	21.70(4.76) [b]
8.	ELC	36.00 (6.08) [ab]	1.78 (1.65) [g]	4.25 (2.26) [g]
9.	MRK	28.00 (5.38) [e]	4.25 (2.26) [d]	13.80(3.83) [e]
10.	KTP	26.00 (5.19) [f]	8.19 (3.02) [b]	24.60 (5.06) [a]
11.	KMR	37.00 (6.16) [a]	1.68 (1.62) [g]	4.16 (2.24) [g]
12.	EDM	28.33 (5.41) [e]	6.25 (2.68) [c]	24.00 (4.99) [a]
SEm±		0.106	0.199	0.176
CD (P≤0.05)		0.310	0.581	0.514
CV (%)		3.320	13.960	7.497

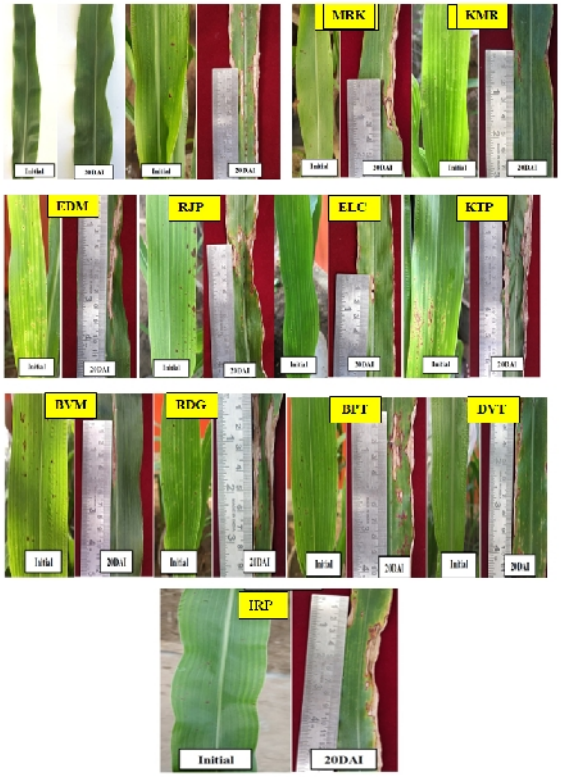

Plate 2. Response of sorghum isolates on maize plants when cross inoculated.

CONCLUSION

Turcicum leaf blight pathogen, *E. turcicum* showed to infect both maize and sorghum. Maximum PDI and lesion length was observed in maize plants when compared to the sorghum plants when cross inoculated. When *E. turcicum* isolates were inoculated on both primary host and collateral host, the lesion length and PDI were high on primary host when compared to the collateral host. With changing climatic conditions, there is certainity of pathogen of a single crop devastating multiple crops resulting in pandamics.

Acknowledgement. I am extremely thankful to my chairperson, members and head of the department for providing support in conducting the experiment smoothly. I also express my heartfelt thanks to Acharya N.G. Ranga Agricultural University for proving financial assistance as a stipend.

Conflicts of Interest. None.

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How to cite this article: Ch. Yamuna, V. Prasanna Kumari, V. Manoj Kumar, K. Jayalalitha and V. Roja (2022). Cross Infectivity Studies of Turcicum Leaf Blight Pathogen (*Exserohilum turcicum*) under Green House conditions. *Biological Forum – An International Journal, 14*(3): 1414-1418.