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In-vitro Screening of Antibiotics Against *Burkholderia glumae causing* Bacterial Panicle Blight of Rice

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ABSTRACT: Bacterial panicle blight is the most devastating disease of rice caused by *Burkholderia glumae.* A study was conducted in taking 23 different antibiotics against *B. glumae* by using inhibition zone technique. Among twenty three antibiotics Rifampicin, Levofloxacin, Tetracycline, Cefotaxime, Azithromycin, Erythromycin, Clarthromycin expressed best result by producing 5.0 mean inhibition zone. The minimum zone of inhibition was recorded by Cefixim and Penicllin - G *i.e.* 1.1 mm after 48 hours.

Keywords: Bacterial Panicle Blight, *Burkholderia glumae,* antibiotics, zone of inhibition.

INTRODUCTION

More than 100 species of bacteria cause diseases in plants and most of the plant pathogenic bacteria are facultative saprophytes and can artificially grown on different media. Plant pathogenic bacteria are present in every place where it is reasonably moist and warm. The bacterial diseases are more common and severe in humid tropics but under favourable environmental conditions they could be extremely destructive. Bacterial diseases of plants are more difficult to control as compared to fungal diseases. Rice production has been severely affected by bacterial panicle blight caused by β proteobacterium *Burkholderia glumae* (Cui *et al*., 2016; Ham *et al*., 2011). B. glumae can cause disease at any stage of plant growth starting from seedling stage to maturity stage (Mondal *et al*., 2015; Kumar *et al*., 2022). At the early stage of plant growth the bacterium cause the seed rot and due to that failure of seed germination can occur. The pathogen cause discoloration of spikelets and interferes with grain development. (Nandakumar *et al*., 2009; Wamishe *et al*., 2015). In severe conditions the entire panicle turns straw coloured and the panicles remain unfilled causing the drastic yield losses (Fory *et al*., 2014; Nandakumar *et al*., 2009). The use of chemicals to control the bacterial disease is generally less successful than the fungal diseases. So, antibiotic may control the disease as some antibiotics are absorbed by the plants and distributed systemically and can be used as sprays or as dips at the time of transplanting (Zhou, 2019). In the agricultural field the most commonly used antibiotic is streptomycin. Unfortunately, bacterial races develop resistance soon after the wide spread application of antibiotics. So, in the present study different antibiotics are tested against the *Burkholderia glumae.*

MATERIALS AND METHODS

A total of twenty three different antibiotics are taken for the study namely Cefpodoxim, Chloramphenicol, Vanomycin, Streptomycin, Rifampicin, Levofloxacin, Ceftriaxone, Clindamycin, Amoxyclav (Amoxycillin / Clavulanic acid), Amikacin, Cefixim, Tetracycline, Ampicillin, Cefuroxima, Cefadroxil, Penicllin–G, Cefotaxime, Cefaclor, Azithromycin, Erythromycin, Cefoperazone, Clarthromycin. Standard bacterial suspension was prepared using the serial dilution technique, taking a loopful of inoculums into a flask containing the 20 ml of distilled water which served as stock solution and further dilutions were made by serial dilution for the screening of antibiotics and 10^6 cfu/ml dilution was used so that the bacterial colonies might be counted easily and the inhibition zone could be measured with greater accuracy. HIMEDIA Dodeca Universal I and II antibiotics disc were taken containing all these 23 antibiotic discs to check their effectiveness against the colonial growth and inhibition zone of the test pathogen *Burkholderia glumae*. The plates were incubated at 28°C for 48 hours. After completion of incubation period the observation were recorded by measuring the diameter of the inhibition zones formed around the antibiotic discs.

RESULT AND DISCUSSION

The inhibition zones formed around the different antibiotic discs were clearly visible against the bacterial growth of *Burkholderia glumae.* It was also observed that *Burkholderia glumae* was effectively controlled by different antibiotics *viz.* Rifampicin, Levofloxacin, Tetracycline, Cefotaxime, Azithromycin, Erythromycin, Clarthromycin as they were found effective with high growth inhibition followed by other

antibiotics like Vanomycin, Streptomycin, Amoxycillin/Clavulanic acid, Amikacin, Cefaclor, Ciprofloxacin. The highest zone of inhibition (5.0 mm) was formed by Rifampicin, Levofloxacin, Tetracycline, Cefotaxime, Azithromycin, Erythromycin and Clarthromycin followed by Cefaclor forming 4.0 mm of zone of inhibition. Amoxyclav (Amoxycillin/ Clavulanic acid) and Streptomycin had zone of inhibition of 3.4mm whereas Vanomycin and Amikacin had 3.2mm and 3.0mm of zone of inhibition respectively. The lowest zone of inhibition (1.1mm) was recorded in two antibiotics *i.e.* Penicllin - G and Cefixim. However, all the 23 antibiotics were found to be effective against the test pathogen *B. glumae.*

Table 1: Evaluation of antibiotics inhibiting *Burkholderia glumae* under *in-vitro*.

Sr. No.	Antibiotic	Symbol	Concentration	Zone of inhibition (mm)
1.	Cefpodoxim	CPD	10 mcg	2.4
2.	Chloramphenicol	C	30 mcg	2.2
3.	Vanomycin	VA	30 mcg	3.2
4.	Streptomycin	S	10 mcg	3.4
5.	Rifampicin	RIF	5 mcg	5.0
6.	Levofloxacin	LE	5 mcg	5.0
7.	Ceftriaxone	CTR	30 mcg	2.5
8.	Clindamycin	CD	2 mcg	1.7
9.	Amoxyclav (Amoxycillin/ Clavulanic acid)	AMC	30 mcg (20/10 mcg)	3.4
10.	Amikacin	AK	30 mcg	3.0
11.	Cefixim	CFM	5 mcg	1.1
12.	Tetracycline	TE	30 mcg	5.0
13.	Ampicillin	AMP	10 mcg	1.8
14.	Cefuroxima	CXM	30 mcg	1.4
15.	Cefadroxil	CFR	30 mcg	2.7
16.	Penicllin - G	P	10 units	1.1
17.	Cefotaxime	CTX	30 mcg	5.0
18.	Cefaclor	CF	30 mcg	4.0
19.	Azithromycin	AZM	15 mcg	5.0
20.	Erythromycin	E	15 mcg	5.0
21.	Cefoperazone	CPZ	75 mcg	1.7
22.	Clarthromycin	CLR	15 mcg	5.0
23.	Ciprofloxacin	CIP	5 mcg	3.0

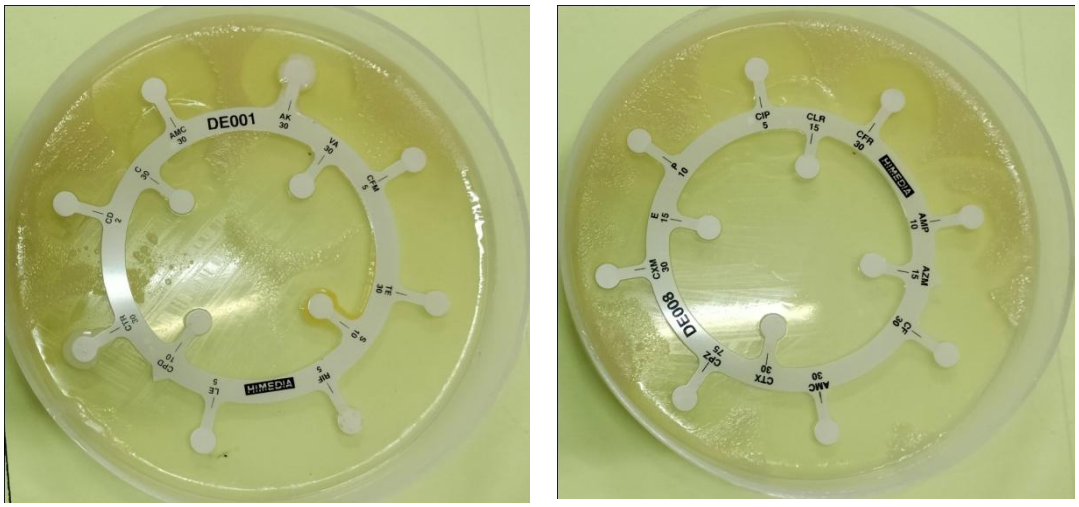

Fig. 1. Showing zone of inhibition by twenty three different antibiotic against *Burkholderia glumae.*

Katsube and Takeda (1998); Shahjahan *et al.* (2000) had tested different antibiotics and observed that Streptomycin sulphate, Kanamycin, Ampicillin trihydrate and Tetracycline were effective against *Burkholderia glumae*. Prasad *et al.* (2018); Deep *et al.* (2020) had reported that Tetracycline is effectively controlling the rice pathogen *Xanthomonas oryzae* pv. *oryzae*. In the present study Tetracycline is also effectively controlling the pathogen *Burkholderia glumae.* Hikichi (1993); Maeda *et al.* (2004) had also tested different chemicals and antibiotics and reported that quinolone antibiotic oxolinic acid was effective against bacterial panicle blight and can be used as seed treatment and foliar spray. In Korea, application of oxolinic acid were scheduled with the forecasting system which used temperature and humidity to calculate the likelihood of a bacterial panicle blight epidemic (Lee *et al.*, 2015). In different countries many antibiotics are not approved for agricultural use still different antibiotics are being tested to overcome the

problem of development of resistance in the bacterial pathogens against a particular antibiotic (Rayanoothala *et al*., 2021).

CONCLUSIONS

In comparison with other plant pathogenic bacteria, a little research has been done on *Burkholderia glumae* causing bacterial panicle blight of rice. The lack of approved and effective chemicals to control this disease makes bacterial panicle blight challenging to manage. In the present study, out of twenty three antibiotics Rifampicin, Levofloxacin, Tetracycline, Cefotaxime, Azithromycin, Erythromycin and Clarthromycin were found effective against *Burkholderia glumae.* Although Streptocycline is widely used in agricultural fields against most of the bacterial pathogens still we should be ready with other antibiotics and chemicals to manage such emerging plant pathogens.

FUTURE SCOPE

Different new chemicals and antibiotics should be tested against this bacterial panicle blight disease as this disease may cause the severe damage in rice crop as there is continuous increase in temperature due to global warming which is favourable for the bacterial pathogens like *Burkholderia glumae*.

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Conflict of Interest. None.

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