

Effect of Seed-borne Fungi on the Germinating Seeds and their Bio-control in Maize

M. Debnath, A. Sultana and A. Q. M. B. Rashid

Seed Pathology Center, Bangladesh Agricultural University, Mymensingh

Abstract

An experiment was conducted in Seed Pathology Center, Bangladesh Agricultural University, Mymensingh to determine the efficacy of biocontrol means (BAU-Biofungicide, Garlic extract and Neem extract) in controlling seedborne fungal diseases of maize (*Zea mays*). In laboratory experiment, the seeds of maize cultivars cv. Badsha-1, Khai Bhutta, Bornali, Mohor, BARI Bhutta- 5 and BARI Bhutta- 6 were tested by blotter method. The identified fungi associated with the seeds were *A. niger*, *A. flavus*, *Fusarium sp.*, *P. oxalicum*, *C. lunata* and *R. stolonifer*. The seed samples were treated with BAU-Biofungicide @ 2.5% of seed weight, neem extract@ 1:2 w/v and 1:3 w/v and garlic extract @ 1:2 w/v and 1:3 w/v to control the seed-borne pathogens. The effective results were recorded as regards to the highest germination (84.5%) reflected the lowest disease incidence (4.0%) recorded in BAU-Biofungicide treated seeds followed by other treatment.

Key words: BAU-Biofungicide, Germination, Seed borne pathogen

Introduction

Maize (*Zea mays L.*) is one of the most important cereal crops in the world and ranks third next to wheat and rice (Aldrich *et al.*, 1975). In Bangladesh, it has a good potential as a cereal crop due to its low cost of production, wide adaptability and diversified use. There are many factors involved in yield loss in which diseases play a significant role. Maize suffers from 28 diseases in seedling stage (Bari and Alam, 2004) in which 11 are seedborne in nature (Fakir, 2001). Among the diseases, seed rot (*F. moniliforme*, *F. oxysporum*, *Penicillium spp.*), seedling blight (*Aspergillus spp.*, *Penicillium spp.*), Bipolaris leaf spot (*B. maydis*), Curvularia leaf spot (*C. lunata*) etc are important ones. Chemical control of seed borne diseases is rather difficult to achieve a reasonably good control. Due to its hazardous environmental effect, the researchers have given attention on bio-control. Therefore the present piece of work has undertaken with the filling the objectives.

Materials and Methods

Test materials

Six maize cultivars collected from BADC of maize growing areas such as Mymensingh, Dinajpur, Madupur, Rangpur and Gazipur. The varieties were Badsha- 1, Khai Bhutta, Bornali, Mohor, BARI Bhutta- 5 and BARI Bhutta- 6. The seed samples

preserved and tested in Seed Pathology Center, Bangladesh Agricultural University, Mymensingh during 2010-11.

Seed health test

Seed health test was done by standard blotter method (ISTA, 2001). The seedborne fungal pathogen associated with seeds was observed by stereobinocular microscope following the key of Mathur and Kongsdal (1994).

Collection of bio-control agents

BAU-Biofungicide (*Trichoderma* based preparation Hossain, 2011) was collected from the Diseases Resistance Laboratory; Garlic and neem extracts were prepared in the Plant Disease Clinic, Department of Plant Pathology, BAU, Mymensingh.

Seed treatment

One hundred seeds of six varieties were treated with each of BAU-Biofungicide @ 2.5% of seed weight, neem extract@ 1:2 w/v, 1:3 w/v and garlic extract @ 1:2 w/v and 1:3 w/v (Rahman *et al.*, 1999) to control the seed borne pathogen.

Experimental design and treatments

The experiment was designed following CRD having four replications and six treatments, where

T₁= Seed treatment with garlic extract @ 1:2 w/v

T₂= Seed treatment with garlic extract @ 1:3 w/v

T₃= Seed treatment with neem extract @ 1:2 w/v

T₄ =Seed treatment with neem extract @ 1:3 w/v
 T₅ =Seed treatment with BAU-Biofungicide (2.5% of seed weight)
 T₀= Control

Results and Discussion

Prevalence of seedborne fungi

Fungi associated with the maize seeds recorded through blotter method are presented in Table 1. The prevalence of *A. niger*, *A. flavus*, *Fusarium spp.*, *P. oxalicum*, *C. lunata* and *R. stolonifer* were varied significantly with respect to variety. Statistically the highest prevalence of *A. niger* was recorded in Khai Bhutta (23.50%) followed the variety of Mohor

(21.00%), *A. flavus* was recorded in Badsha-1 (21.50%) followed by the variety of Bornali (19.50%), *Fusarium sp.* was recorded in Mohor (13.75%) followed by the variety of Bornali (12.50%), *P. oxalicum* was recorded in Badsha- 1 (12.25%) followed the variety of Khai Bhutta (9.50%), *C. lunata* was recorded in Khai Bhutta (6.25%) followed by the variety of Mohor (5.75%), *R. stolonifer* was recorded in Khai Bhutta (12.50%) followed by the variety of Mohor (11.50%). The least but similar prevalence of the fungi was recorded in rest of the varieties tested. In agreement with the present findings Fakir (2001), Bari and Alam (2004) also reported the same.

Table 1. Prevalence of fungi associated with the maize seeds (blotter method)

Variety	Prevalence of fungi (%)					
	<i>Aspergillus niger</i>	<i>Aspergillus flavus</i>	<i>Fusarium sp.</i>	<i>Penicillium oxalicum</i>	<i>Curvularia lunata</i>	<i>Rhizopus stolonifer</i>
Badsha-1	18.75c	21.50a	11.50c	12.25a	4.50bc	10.00cd
Khai Bhutta	23.50a	13.50d	11.25cd	9.50b	6.25a	12.50a
Mohor	21.00b	18.25c	13.75a	7.75cd	5.75a	11.50ab
Bornali	18.25c	19.50b	12.50b	9.00b	3.50c	11.00bc
BARI Bhutta- 5	18.50c	11.50e	10.50d	8.75bc	5.25ab	9.50de
BARI Bhutta- 6	19.25c	9.00f	11.50c	7.00d	3.50c	8.75e

Effect of the fungi on germinating seeds

Effect of the fungi on germination of maize seeds of six cultivars is presented in the Figure 1. The effect significantly differed from cultivar to cultivar. Significantly, the highest germination failure was recorded in Khai Bhutta (29.50%) in which maximum prevalence of various fungi were recorded. The result was followed by other varieties. The highest effect of the fungal prevalence reflected the lowest

germination as recorded in which significantly maximum prevalence were recorded the fungi species *Aspergillus niger*, *Curvularia lunata*, *Rhizopus stolonifer* and *Penicillium oxalicum*. The present findings of the seed borne fungal organisms were in agreement with the information of seed borne nature of the pathogen reported by Marley and Gbenga (2004).

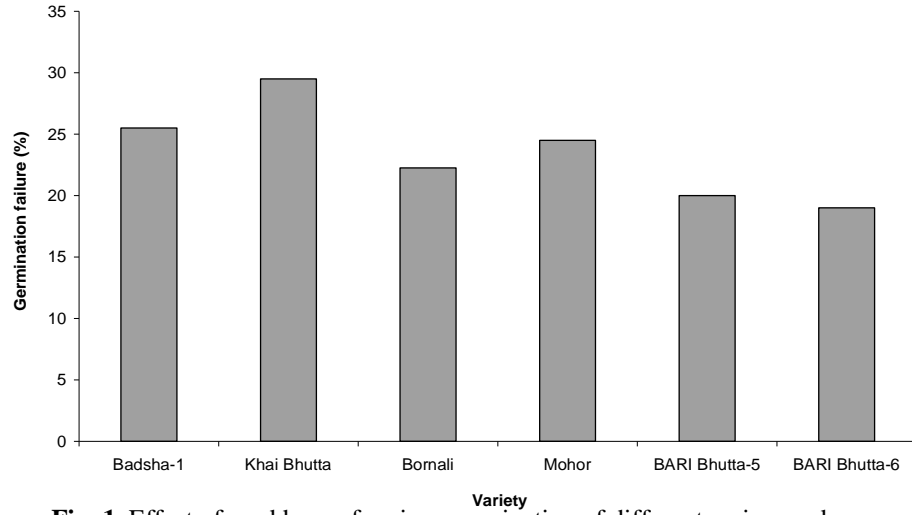


Fig. 1. Effect of seed borne fungi on germination of different maize seed

Effect of seed treatment by different plant extracts and BAU-Biofungicide on germination of maize seeds

The effect of garlic extract (1:2, 1:3), neem extract (1:2, 1:3) and BAU-Biofungicide (2.5% of seed

weight) on the seed borne pathogen associated with germinating seeds Khai Bhutta is presented in Figure 2. Seed treatment by plant extracts and BAU-Biofungicide showed great impact on germination and reducing the disease incidence.

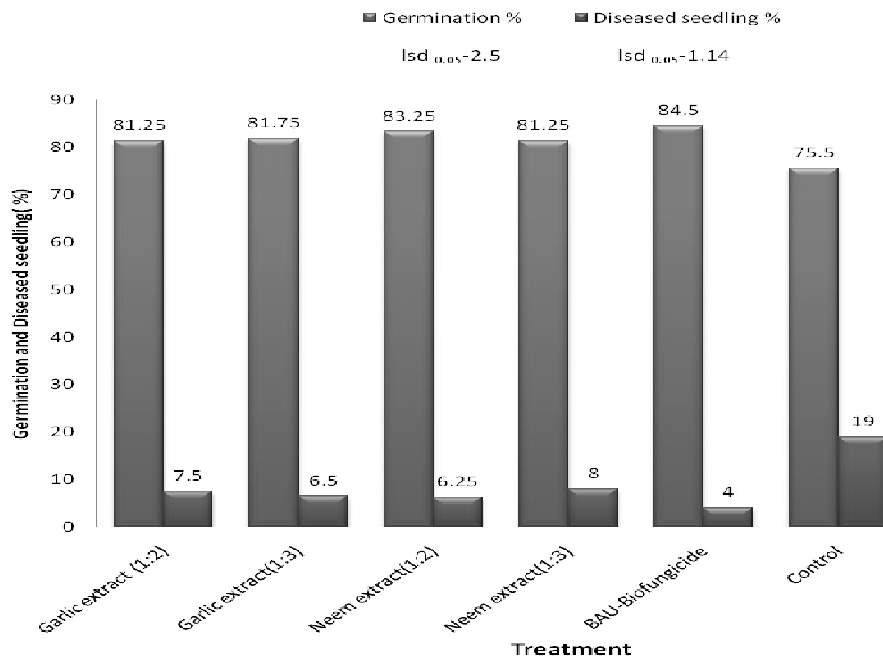


Fig. 2. Effect of plant extracts and BAU-Biofungicide on germination of the maize seed (cv. Khai Bhutta)

It is revealed from the Figure 2 that significantly the highest germination (84.5%) reflected the lowest disease incidence recorded in the seeds treated by BAU-Biofungicide @ 2.5% followed by the other treatments. The least germination (75.5%) and the highest disease incidence (10%) were recorded in control. Therefore, the result of the present findings is agreed with the results of other workers Rahman (2006) and Awal (2005).

Conclusions

The garlic extract, neem extract and the BAU-Biofungicide showed the significant result in controlling seedborne fungal pathogen in maize. Among them, the BAU-Biofungicide has the strong potentiality for treating seeds of maize in controlling seed and seedling diseases. So, the seed treatment by BAU-Biofungicide should be widely explored to the country.

References

- Aldrich, S. R.; Scott, W. O. and Leng E. R. 1975. Modern corn production. 2nd edition. United States of America. pp. 1-5.
- Awal, K. J. M. 2005. Determination of effective dose of garlic tablet and its durability in controlling seedling disease of eggplant. MS. thesis submitted to the Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh . 1-88pp.
- Bari, M. A. and Alam, M. S. 2004. Major diseases of wheat and maize and their control. A Bengali Booklet published from the Division of Plant Pathology, BARI, Joydebpur, Gazipur 2: 12-16.
- Fakir, G. A. 2001. List of seed borne diseases of important crops occurring in Bangladesh. Seed Pathol. Lab., Dept. Pl. Pathol., Bangladesh Agricultural University, Mymensingh. 9p.
- Hossain, I. 2011. BAU-Biofungicide: Unique Eco-friendly Means and New Dimension of Plant Disease Control in Bangladesh. Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh.
- ISTA (International Seed Testing Association). 2001. International Rules for Seed Testing. Rules Amendments. Seed Sci. and Tech. 29 (2): 1-127.
- Marley, P. S. and Gbenga, O. 2004. Fungicide control of *Stenocarpella maydis* in the Nigerian Savanna. Archives of Phytopathology and Plant Protection. 37 (1): 19-28.
- Mathur, S. B. and Kongsdal, O. 1994. Seed mycology. Description and Illustrations of fungi. DGISP for Developing, Denmark, 1st edn.
- Rahman, M. M. 2006. Biological control of seedling diseases of papaya, Water melon and melon. MS. Thesis submitted to the Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh.
- Rahman, G. M. M., Islam, M. R. and Wadud, M. A. 1999. Seed treatment with plant extracts and hot water, potential biophysical method of controlling seed-borne infection of wheat. *Bangladesh J. Train. Dev.* 12 (1-2): 185-190.