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Evaluation of bio-formulations for management of storage rot of seed tubers of Colocasia (*Colocasia esculenta*)

B Bora[1*] and P Handique[2]

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[1]*Biswanath College of Agriculture, AAU, Biswanath Chariali, Assam, India*

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ABSTRACT

The seed tubers of Colocasia (*Colocasia esculenta* L.) collected from different locations were treated with several bio-formulations, *viz*. Biofor PF-2, Biomonas, Bioveer and Biozin PTB at 5% concentration to evaluate their efficacy in protecting the seed tubers from rotting in storage. Biozin PTB was found to be the most effective with lowest incidence (8.84%) of rot among all bio-formulations. The seed tubers treated with Biozin PTB recorded highest reduction (80.94%) of rot incidence over the control.

KEY WORDS: Bio-formulations, Cormlets, Rot incidence, Seed tubers, Storage rot

Colocasia (*Colocasia esculenta* L.) grown in Lakhimpur district. The multiple cropping systems also suprerss weeds, pests and diseases (Nedunchezhian *et al.*, 2022). Phytophthora blight *(Phytophthora colocasiae)* and Pythium root and corm rot (*Pythium* spp.) are most devastating fungal diseases. Post-harvest loss of tubers, particularly corms and cormels has become a serious problem, resulting in high price of seed tubers. Degeneration occurs due to successive accumulation of pathogens and pests (Paul *et al.*, 2022). The *A. niger, A. flavus, Geotrichum candidum, Rhizopus oryzae* were isolated from rotten tubers (Khatoon *et al.*, 2016). Botanicals were also found to be effective in controlling post-harvest decay of colocasia (Khatoon *et al.*, 2018). Therefore, study was undertaken to evaluate bio-formulations for prevention of storage rot of seed tubers in Agro-ecological condition of Lakhimpur District of Assam.

MATERIALS AND METHODS

Fresh samples of seed tubers were collected from different colocasia-growing areas of Lakhimpur district of Assam, *viz*. Shimaluguri, Bahupathar, Phulbari, Boginodi and Madhabpur during *rabi* season of 2016 and 2017. The experiment was conducted in a completely randomized block design with four replications. Six kg of seed tubers from each location were taken. Bio-formulations, *viz*. Biofor PF-2, containing *Pseudomonas fluorescens* and *Trichoderma harzianum*, Biomonas, containing *Pseudomonas fluorescens*, Bioveer, containing *Trichoderma viride*, and Biozin PTB, containing *Pseudomonas aeruginosa*, *Trichoderma harzianum*, and *Bacillus brevis* were collected from Biocontrol Laboratory, Department of Plant Pathology, Assam Agricultural University, Jorhat.

The seed tubers were treated with bio-formulations @ 5% (5 kg in 100 litres of water) for one hour and dried under shade and stored at room temperature till the time of planting in February. For control experiments, sterile water was used. The number of rotted seed tubers in each lot were recorded starting 15 days after storage and at 15 days intervals. The per cent rot incidence of seed tubers was determined by following to that of Gollifer and Booth (1973). The data were analyzed by the OPSTAT statistical software package after angular transformation wherever necessary. The data were subjected to analysis of variance, and the means were analyzed, using Duncan's new multiple range post-test at $p \leq 0.05$.

RESULTS AND DISCUSSION

All bio-formulations were found to be effective in managing storage rot of seed tubers after five months of storage (Table 1). The Biozin PTB was found most effective with the lowest incidence (8.84%) of rot, followed by Biofor PF and Biosona with 16.24% and 12.28% rot incidence, respectively. The seed tubers

*Corresponding author : budha.bora@aau.ac.in

[2] KVK, AAU, Lakhimpur, Assam

Table 1. Efficacy of bio-formulations on storage rot of seed tubers of colocasia

Treatment	Rot incidence (%)	Reduction of rot incidence over control (%)
Biozin PTB	8.84(20.473)[d]	80.94
Biofor PF	12.28(23.749)[c]	73.52
Biosona	16.24(28.82)[b]	64.98
Bioveer	23.26(42.923)[a]	49.85
Control	46.38(17.235)[e]	
CD (0.05)	2.68	

* Data within the parentheses are angular transformed values
** Data are mean of two years and four replications

treated with Bioveer recorded lowest (23.26%) incidence of rot. The highest reduction (80.94%) of rot incidence over the control was recorded in Biozin PTB treated samples, followed by Biofor PF and Biosona with 73.52%, and 64.98% reduction of rot incidence over the control, respectively. The lowest reduction (49.85%) of rot incidence over the control was observed in samples treated with Bioveer (Table 1). The combination of all three antagonists contained in bio-formulation (Biozin PTB) was found to be most effective.

The efficacy of *Trichoderma viride* as an effective biocontrol agent against *Fusarium oxysporum* was reported by several researchers (Kumari *et al.*, 2014). Talc formulation of *Pseudomonas flourescens* showed higher inhibitory action against *Fusarium oxysporum* f. sp. *cubense*. Akram *et al.* (2013) also reported that tomato plants inoculated with *Bacillus thuringiensis* had resulted in a significant reduction of fungal wilt caused by *Fusarium oxysporum*. Combination of *Trichoderma viride, Pseudomonas flourescens, Metarhizium anisopliae,* and *Bacillus thuringiensis* significantly inhibited the *Fusarium oxysporum* f. sp. *lactucae* isolated from hydroponically grown lettuce (Khan *et al.*, 2021).

A similar observation was also made by Bora *et al.* (2020). Among all, *Trichoderma viride, Pseudomonas flourescens,* and *Bacillus thuringiensis* were found to be most effective in inhibiting the pathogen *in vitro*. Keswani *et al.* (2016) reported that *Trichoderma* spp. induces systemic resistance in plants by releasing not only proteins but also secondary metabolites and controls plant diseases. The fungal biocontrol agent Trichoderma employs a variety of mechanisms such as hyper parasitism, antibiosis, and competition (Singh *et al.*, 2014; Bora *et al.*, 2013).

The bacterial biocontrol agent *Pseudomonas flourescens* inhibits plant pathogens through the production of antibiotics, siderophore, antifungal metabolites, and lytic enzymes (Sharma *et al.*, 2020). The bio-insecticide, *Bacillus thuringiensis* also can control plant pathogens such as *Fusarium oxysporum, F. sambocinum* and *F. graminearum* by secreting different types of enzymes (Baysal *et al.*, 2013). In our study, all the bioformulations showed promise in minimizing the storage rot of seed tubers with varying degrees of effectiveness. However, Biozin PTB was found to be most effective bioformulation.

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