Biological Forum – An International Journal **15(1): 685-688(2023)**

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

Evaluation of Fungicide compatibility with a Co-culture of *Trichoderma* spp. under *in vitro* Conditions

A.G. Panda[1*], B. Boblina[1], M.K. Mishra[1], A.K. Senapati[1], D. Datta[2] and B. Jena[1]
[1]Department of Plant Pathology, OUAT, Bhubaneswar (Odisha), India.
[2]Department of Plant Pathology, Institute of Agricultural Sciences, SOA DU (Odisha), India.

(Corresponding author: A.G. Panda)*
(Received: 07 December 2022; Revised: 29 December2022; Accepted: 04 January, 2022; Published: 21 January, 2023)
(Published by Research Trend)

ABSTRACT: For agriculture to be sustainable, soil-borne plant diseases must be effectively controlled. The compatibility of two native *Trichoderma* spp. strains (TAKJR and THPUR) with six fungicides to combat *Rhizoctonia solani* is examined in this study. We assessed the inhibitory effects of fungicides at doses between 100 PPM and 1500 PPM. Hexaconazole mildly inhibited TAKJR (46.7%), according to the results, but at 1500 PPM, the inhibition dramatically increased to 93.3%. At 1500 PPM, Difenoconazole demonstrated substantial (95.6%) inhibition of TAKJR. At 1500 PPM, Tebuconazole showed moderate inhibition, rising to 90.6%. At 100 PPM, inhibition by Propineb increased to 48.6% at 1500 PPM. Moderate inhibition was seen with Propiconazole. Pencycuron, the most suitable fungicide, showed little inhibition at 1500 PPM (11.9%). Hexaconazole and Difenoconazole had excellent inhibitions at 1500 PPM (96.7% and 95.6%, respectively), while THPUR demonstrated similar responses. The inhibition of Tebuconazole ranged from 40.8% to 90.6%. Pencycuron and Propineb demonstrated negligible inhibitory effects. The study shows that fungicides have inhibitory effects on *Trichoderma* spp. in a dose-dependent manner. Their inclusion in an integrated disease control schedule is suggested by their compatibility with particular fungicides, most notably Pencycuron.

Keywords: *Trichoderma*, Fungicide compatibility, Pencycuron.

INTRODUCTION

In order to keep plant diseases at bay, several biological control agents are available. Fungi, bacteria, and actinomycetes are all examples of them. *Trichoderma, Bacillus, Pseudomonas,* and *Streptomycetes* are the most prevalent BCAs (Wedajo, 2015). In order to treat soil-borne plant infections like *Fusarium, Phytophthora, Pythium, Rhizoctonia,* and *Sclerotium, Trichoderma* spp. have been researched extensively as a biocontrol agents (Benitez *et al.,* 2004; Ranganathswamy *et al.,* 2012). Farmers are utilising a variety of fungicides for the control of these diseases, but the results have been less than ideal. Moreover, chemical fungicides are expensive to use, and their residue is a major problem that pollutes the environment, poses health risks to humans, and has a negative impact on the soil's beneficial microorganisms. These bioagents need to be fungicide-compatible so that they can be used in an integrated disease management scheme. Synergistic or additive effects in the management of soil-borne diseases have been the focus of significant research into the combined use of biocontrol agents and chemical pesticides (Arain *et al.,* 2022). Soil-borne and seed-borne inoculum can be prevented by using fungicides and suitable bio agents in a coordinated IDM strategy (Patel and Dubey 2001). When BCAs are used in conjunction with fungicides, disease suppression is on par with that achieved by using more fungicides alone. Fungicide use can be reduced and the risk of resistance to the fungicide minimised if natural antagonists are combined with synthetic ones. Further, this approach may show improved control of fungal infections resistant to fungicides and may aid commercial producers in reducing fungicide use, hence reducing chemical residue in sold products (Wedajo, 2015).

MATERIALS AND METHODS

Six fungicides *viz.,* Hexaconazole 5% EC, Difenoconazole 25% EC, Tebuconazole 25.9% EC, Propineb 25% WP, Propiconazole 25% EC and Pencycuron 22.9% SC (each @ 100 ppm, 500 ppm, 1000 ppm and 1500 ppm) that were found effective against *Rhizoctonia solani*in our previous research study were considered for testing their compatibility with two potential native strains of *Trichoderma* spp. (TAKJR and THPUR) by poisoned food technique. The double strength potato dextrose agar medium was made in distilled water and sterilized in an autoclave for 20 minutes at 15 psi pressure (121.6 °C). Before pouring the medium, aseptic preparations of 100, 500, 1000, and 1500 ppm of each fungicide were made according to commercial formulation and added. To keep everything under control, sterile water was introduced to the medium in place of the fungicide solution. A 5 mm mycelial disc was prepared from a 10-day-old cultures of *Trichoderma* spp. was used to inoculate medium plates (Panda *et al.*, 2019; Boblina *et al.*, 2020). After 5 days of incubation, we documented our findings on the radial expansion of *Trichoderma* spp. Following the method described by Vincent (1947), we determined the percentage of inhibition for each therapy.

$$I(\%) = \frac{C - T}{C} \times 100$$

Where;
I (%) = Per cent mycelial inhibition
C = Mycelial growth in control
T = Mycelial growth in treatment

RESULTS AND DISCUSSION

Two possible native strains of *Trichoderma* spp. (TAKJR and THPUR) were investigated for their compatibility with six fungicides that were proven to be efficient against *Rhizoctonia solani*. Inhibition of TAKJR by hexaconazole 5% EC at 100 PPM was moderate (46.7%) (Fig. 1, 3). However, the inhibition percentages considerably increased to 80.3%, 90.3%, and 93.3%, respectively, at 500 PPM, 1000 PPM, and 1500 PPM, demonstrating a dose-dependent inhibitory action. Difenoconazole 25% EC demonstrated reasonably significant TAKJR inhibition at 100 PPM (62.5%), which progressed to strong inhibition at 500 PPM (87.5%), 1000 PPM (90.8%), and 1500 PPM (95.6%). At 100 PPM (26.7%), tebuconazole 25.9% EC showed just a little inhibition; at 1500 PPM, this inhibition climbed to 90.6%. On the other hand, propineb 25% WP displayed no inhibition at 100 PPM, showing compatibility with TAKJR at this level. The inhibition percentages at 1000 PPM and 1500 PPM were 45.8% and 48.6%, respectively, demonstrating a rather modest inhibitory impact even at higher doses. At 500 PPM, the inhibition was negligible (11.1%). Moderate inhibition was seen with propiconazole 25% EC. The most suitable fungicide was discovered to be Pencycuron 22.9% SC, which showed no inhibition at doses of 100 PPM and 500 PPM. At 1500 PPM, the inhibition percentage climbed to 11.9% from 1.9% at 1000 PPM, indicating just a minor inhibitory effect.

The results for THPUR followed the same trend (Fig. 2 and 4) as those shown in testing for TAKJR compatibility. Especially noteworthy were the substantial inhibitory effects that Hexaconazole 5% EC and Difenoconazole 25% EC showed at all doses. These fungicides exhibited impressive inhibitions of 96.7% and 95.6%, respectively, at 1500 PPM. Their potent antifungal action against THPUR is shown by this dose-dependent response. Tebuconazole 25.9% EC, on the other hand, exhibited moderate inhibitory effects, with its percentage inhibition varying between 40.8% and 90.6% at various dosages. Both the fungicides Propineb 25% WP and Pencycuron had modest inhibitory effects, showing no inhibition at 100 PPM and very little inhibition at higher doses. Our findings were in line with those of Elshahawy *et al.* (2016), who showed that *Trichoderma* spp. isolates were completely compatible with Flutolanil (Moncut 25% WP), Pencycuron (Monceren 25% WP), and Thiophanate-methyl (Topsin-M 70% WG) at concentrations of 50, 100, 200, 300, 400, and 500 ppm and only slightly at 600, 700, and 800 ppm. The same findings were made by Madhavi *et al.* (2011) about the complete compatibility of Pencycuron and Propineb with *Trichoderma viride.*

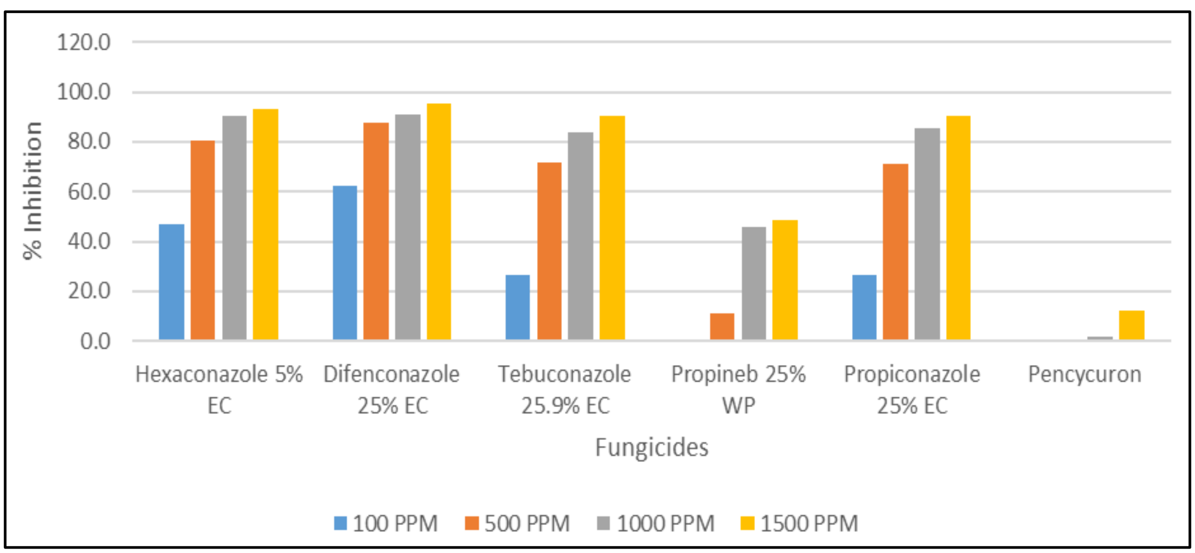

Fig. 1. Compatibility of fungicides with TAKJR.

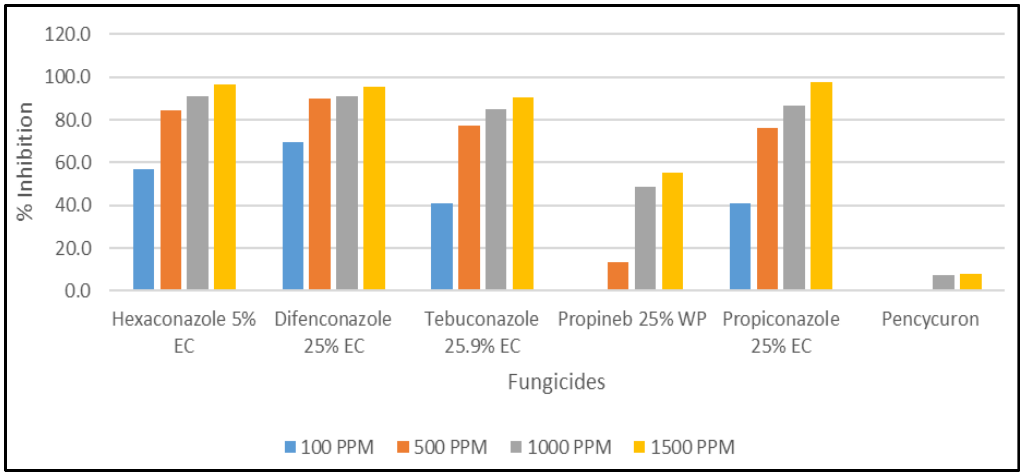

Fig. 2. Compatibility of fungicides with THPUR.

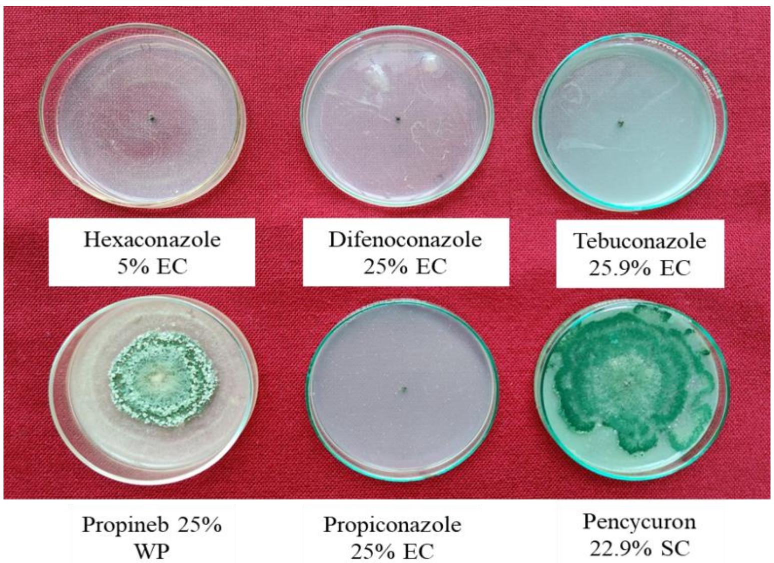

Fig. 3. Compatibility of fungicides with TAKJR at 1000 ppm.

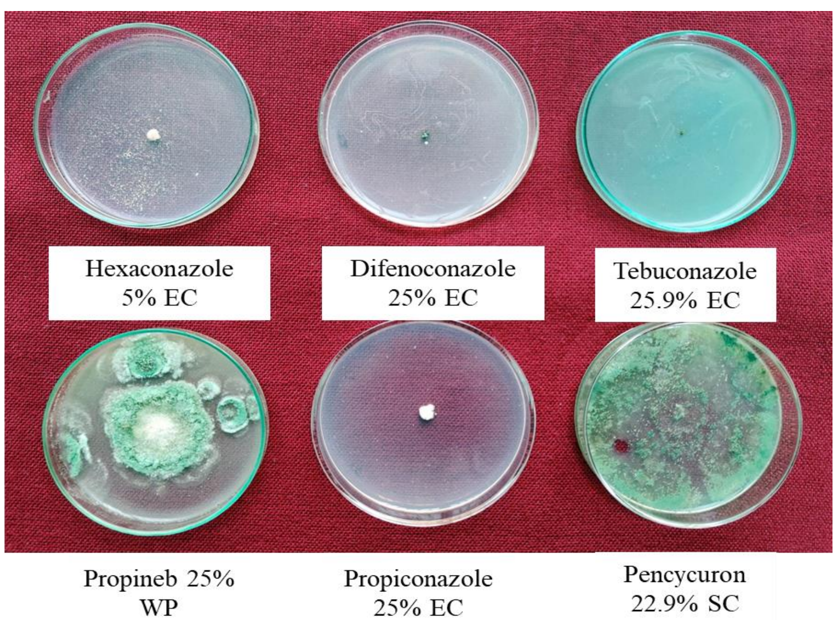

Fig. 4. Compatibility of fungicides with THPUR at 1000 ppm.

CONCLUSION AND FUTURE SCOPE

According to the compatibility test, various fungicides, including Hexaconazole and Difenoconazole, significantly inhibited *Trichoderma* at all doses examined. Propineb and Pencycuron, on the other hand, showed no inhibition even at greater doses, indicating compatibility with *Trichoderma*. Tebuconazole and propiconazole showed only modest inhibition, with higher doses having a greater effect. When developing sustainable plant disease control techniques, the information from this research study emphasizes the need of carefully considering how fungicides affect beneficial organisms like *Trichoderma*. Although Hexaconazole and Difenoconazole have strong antifungal properties, they may also have a negative impact on populations of *Trichoderma*. Tebuconazole, Propineb, and Pencycuron, on the other hand, show increased compatibility with *Trichoderma*, making them suitable candidates for integrated pest management programs meant to take use of this helpful fungus' biocontrol capabilities. In the end, our findings offer insightful information for fungicide-*Trichoderma* combination optimization, providing efficient disease control while safeguarding the critical ecological functions of *Trichoderma* in agricultural settings.

Moving forward, these findings present a promising avenue for advancing sustainable plant disease management. The study's emphasis on understanding fungicide effects on beneficial organisms like *Trichoderma* underscores the importance of incorporating compatibility assessments into agricultural practices. Further investigation into the mechanisms underlying the variable inhibition patterns, as well as field validation of the compatibility of Tebuconazole, Propineb, and Pencycuron with *Trichoderma*, can refine integrated pest management strategies. This research sets the stage for optimizing fungicide-*Trichoderma* combinations to achieve effective disease control while upholding pivotal ecological roles of *Trichoderma* within agricultural ecosystems.

Acknowledgement. The authors would like to express their appreciation to the RKVY Project on Biocontrol at Odisha University of Agriculture and Technology and the Department of Plant Pathology for providing the necessary resources to carry out this study.

Conflict of Interest. None.

REFERENCES

Arain, U., Ujjan, A. A., Rajput, A. Q., & Shahzad, S. (2022). Synergism between *Trichoderma harzianum* rifai and chemical fungicide for the control of *Fusarium oxysporum* schltdl. on mung bean. *Pakistan Journal of Phytopathology*, *34*(1), 117-125.

Benitez, T., Rincón, A. M., Limón, M. C., & Codon, A. C. (2004). Biocontrol mechanisms of *Trichoderma* strains. *International microbiology*, *7*(4), 249-260.

Boblina, B., Beura, S. K., Panda, A. G. and Mishra, M. K. (2020). Evaluation and assessment of shelf life of liquid substrates and talc formulation for mass production of native *Trichoderma spp. Journal of Pharmacognosy and Phytochemistry*, *9*(3), pp.911-915.

Elshahawy, I. E., Haggag, K. H., & Abd-El-Khair, H. (2016). Compatibility of *Trichoderma* spp. with seven chemical fungicides used in the control of soil borne plant pathogens. *Research Journal of Pharmaceutical Biological and Chemical Sciences*, *7*(1), 1772-1785.

Madhavi, G. B., Bhattiprolu, S. L., & Reddy, V. B. (2011). Compatibility of biocontrol agent *Trichoderma viride* with various pesticides. *Journal of Horticultural Sciences*, *6*(1), 71-73.

Panda, A.G., Mishra, M.K., Beura, S.K. and Boblina, B. (2019). Evaluation of Local *Trichoderma* Isolates against Potential Soil Borne Pathogens of Pulses. *International journal of current microbiology and applied sciences*, 8(09), p.2019.

Patel, B., & Dubey, S. (2002). Determination of tolerance in *Thanatephorus cucumeris*, *Trichoderma viride*, *Gliocladium virens* and *Rhizobium sp*. to fungicides.

Ranganathswamy, M., Patibanda, A. K., Chandrashekhar, G. S., Sandeep, D., Mallesh, S. B., & Kumar, H. H. (2012). Compatibility of *Trichoderma* isolates with selected fungicides in vitro. *International Journal of Plant Protection*, *5*(1), 12-15.

Vincent, J. M. (1947). Distortion of fungal hyphae in the presence of certain inhibitors. *Nature*, *159*(4051), 850-850.

Wedajo, B. (2015). Compatibility studies of fungicides with combination of *Trichoderma* species under in vitro conditions. *Virol. Mycol.*, *4*(2), 149-153.

How to cite this article: A.G. Panda, B. Boblina, M.K. Mishra, A.K. Senapati, D. Datta and B. Jena (2023). Evaluation of Fungicide compatibility with a Co-culture of *Trichoderma* spp. under *in vitro* Conditions. *Biological Forum – An International Journal, 15*(1): 685-688.