Management of *Thrips tabaci* Lindeman in onion using *Pseudomonas fluorescens* Migula through induced resistance

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ABSTRACT

Among the various biocontrol agents, *Pseudomonas fluorescens* Migula, a strain of Plant Growth Promoting Rhizobacteria (PGPR) is being exploited commercially for plant protection to induce systemic resistance against various insect pests and diseases. The foliar application of *P. fluorescens* has been reported to enhance the activity of defense related enzymes *viz.,* Peroxidase (POD), Polyphenoloxidase (PPO) and Phenylalanine Ammonia-lyase (PAL) in the plant system. The experiment was conducted to know the effect of induced resistance in onion through foliar application of *P. fluorescens* on onion thrips, *Thrips tabaci.* Onion thrips is the major insect pest of onion and it is identified as a pest of national importance which causes an annual yield loss of about 10 to 15 per cent in India. The results indicated that the highest activity of POD (0.70 mg protein/min), PPO (0.54 mg protein/min) and Phenylalanine Ammonia-lyase (0.30 mg/100 mg) was recorded in *P. fluorescens* treated onion plants. The activity of these enzymes was negatively correlated with thrips population. The minimum activity of all three enzymes was observed from untreated check. These enzymes involved in the production of phytoalexins and phenolics in onion plant and thus, the induced resistance played an important role in the management of *Thrips tabaci*.

Key words: Onion, *Pseudomonas fluorescens*, peroxidase, polyphenoloxidase, phenylalanine ammonia-lyase, *Thrips tabaci*

INTRODUCTION

Onion, *Allium cepa* L. (*Alliaceae*) is the fourth most important commercial vegetable crop in India. India is the second largest onion growing country in the world. Onion occupies an area of 8,34,000 hectares which is 10.40 per cent of total vegetable area (www.nhb.gov.in). Among the various insect pests attacking onion, Onion thrips, *Thrips tabaci* is identified as a pest of national importance in India. It causes an annual yield loss of 10-15 per cent in onion (Gupta *et al.,* 1994; Diaz-Montano *et al.,* 2011). Besides the economic cost, environmental problems and residue persistence, it is difficult to control this pest with insecticides because of its small size and cryptic habits (Lewis, 1997). It also causes indirect damage as vector of viral disease, Iris yellow spot virus of Tospovirus genus which has spread in many important onion producing regions of the world (Diaz-Montano *et al.,* 2011).

The application of *P. fluorescens* has been reported to enhance the activity of defense related enzymes. The oxidative enzymes like Peroxidase and polyphenol oxidase are involved in the oxidation of phenolics to quinine which is toxic to herbivore (Sanjayan, 2008). Phenylalanine amonia-lyase is a key enzyme of phenylpropanoid metabolism which leads to the synthesis of phenolics (Ramamoorthy, 2002). The phenolic compound, 2, 4-diacetylphloroglucinol (2, 4-DAPG) produced by *P. fluorescens* play an important role in plant protection through induced resistance (Schnider-Keel *et al.,* 2000). In this context, the need for alternative method of thrips control in onion has become vital. The present study has been carried out to assess the effect of foliar application of talc-based formulation of *P. fluorescens* on the activity of defense enzymes and possible role in the management of *Thrips tabaci* in onion.

MATERIALS AND METHODS

The pot culture experiment was carried out to study the effect of foliar application of *P. fluorescens* on the activity of enzymes. The nutrients, NPK, FYM, biofertilizers and neem cake were applied at the time of planting. The talc based formulation of *P. fluorescens* was applied as foliar spray. The locally grown variety of onion was used and experiment was replicated thrice. The talc based formulation of *P. fluorescens* (2.5×10^8 cfu/gm) was obtained from the Department of Plant Pathology, TNAU, Coimbatore and used as a foliar spray. The talc based product was dissolved in water at the rate of 5 g per litre and allowed to settle for one hour, filtered through muslin cloth and the filtrate was sprayed (Nayer, 1996; Nandakumar *et al.*, 2001) at 30 days after planting. Fresh leaf samples of plants were collected from *P. fluorescens* treated plants at 45 days after planting and analysed for the activity of Peroxidase, Polyphenoloxidase and Phenylalanine ammonia-lyase. Peroxidase (Hartee, 1955), Polyphenol oxidase (Mayer *et al.*, 1965), and Phenylalanine ammonia-lyase (Dickerson *et al.*, 1984) activity was determined according to the procedure described by activity was determined as per the standard procedures.

RESULTS AND DISCUSSION

The highest activity of peroxidase enzyme was recorded in *P. fluorescens* treated plants (0.70 mg protein/min) as against 0.35 mg protein/min in untreated check. The highest polyphenoloxidase activity of 0.54 mg protein/min was recorded in *P. fluorescens* treated plants while the minimum polyphenoloxidase activity was noticed in untreated check (0.34 mg protein/min). PAL activity was more in *P. fluorescens* (0.30 mg protein/min) treated plants and minimum of 0.20 mg/100mg was recorded in untreated check. This is in line with the findings of Karthikeyan *et al.* (2005) who reported the enhanced activity of defense related enzymes *viz.*, peroxidase, Polyphenoloxidase and Phenylalanine Ammonia-lyase from *P. fluorescens* treated onion plants.

The lowest thrips population of 7.34 and 6.21 per plant was recorded in *P. fluorescens* treated onion plants as against 16.66 and 15.12 per plant in untreated check in both bulb planted and transplanted onion, respectively. The activity of these enzymes was negatively correlated with thrips population. This is in agreement with the findings of Sathish and Raguraman (2007) who reported that activity of these defense related enzymes were negatively correlated to *Helicoverpa armigera* infestation in tomato. Murugesan and Kavitha (2009) reported the effectiveness of *P. fluorescens* against leafhopper, *Amrasca devastans* (Distant) in cotton through induced resistance. These results suggest that induction of defense enzymes involved in phenylpropanoid pathway and accumulation of phenolics might have contributed to induced resistance against *T. tabaci.*

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