

Management of Guava (*Psidium guajava* L.) Wilt (*Fusarium oxysporum* & f. sp. *psidii*) through Bioagents

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Abstract

The adverse impact of chemical fungicides on the soil, environment and farmer health is well known. Now emphasis are being given to use other alternative to control/management the plant disease which could be ecofriendly. Biocontrol agents are gaining importance in plant disease management. Hence, in the present study, attempts a pot culture experiment, have been made to find out suitable biocontrol agents for management of guava *Fusarium* wilt which is common in guava orchards. Four strains of *Trichoderma* viz. *T. harzianum*, *T. hamatum*, *T. viride* and *T. virens* and also *Aspergillus niger* and *Gliocladium virens* were tried for biocontrol of *Fusarium* spp., a causative agent of guava wilt disease. Among these bioagents, *T. harzianum* worked out to be the best.

Key words : Wilt, Management, Biocontrol agents.

Guava (*Psidium guajava* L.) is most common fruit crop of sub-tropical and belongs to family Myrtaceae. It is also known as poor man's apple and grown in all the state of India. Bihar has the largest area (24.7 thousand ha) under guava cultivation followed by Uttar Pradesh (18.5 thousand ha) and Maharashtra (14.8 thousand ha). The per ha productivity is the highest in Madhya Pradesh (20 t/ha) compared to low in Uttar Pradesh (7.3 t/ha). In Uttar Pradesh, Allahabad is the homeland of guava and its known for the famous guava cv Allahabad safeda. It is a hardy crop and is cultivated successfully even in neglected soil. Guava is attacked by large number of pathogens, mainly fungi. Wilt (*Fusarium oxysporum* f. sp. *psidii*) stands first amongst the important fungal diseases of guava. Guava wilt disease was first reported from the Babakarpur area of Allahabad in 1935. Wilt is most destructive disease of guava (*Psidium guajava* L.) in India and abroad. In recent years the production of guava had been significantly reduced by wilt disease. Symptoms of wilt included gradual, sometimes sudden yellowing and browning of leaves at the tip of twigs. Leaves die and the twig bark splitting. The dry of leaves and terminal branches are followed by complete dying of entire plant. The finer roots showed black streaks, which become prominent on removing

the bark. The roots also show rotting at the basal region and the bark is easily detachable from the cortex. The cortical regions of the stem and root show discoloration, noticed in vascular tissues (1). Wilt fungus in guava penetrated either directly through the root piliferous layer of seedlings or through openings caused by secondary roots (2). In view of the growing problem for disease management by chemical means due to environmental pollution and health hazards more and more former are now becoming interested in disease management through bioagents. The biocontrol agents, *Trichoderma viride* and *Aspergillus niger* are widely distributed fungal species in all agriculture soils. These are known to play important role in suppression of soil borne plant pathogenic fungi (3). Antagonistic properties of *Trichoderma* sp., *Aspergillus niger* and *Gliocladium virens* have been revealed by several workers (4—7) The present investigation was carried out with a view to find out an effective biocontrol agent for management of guava wilt.

Methods

Various biocontrol agents with biocontrol activity against soil borne pathogens were used in screen-

Table 1. Efficacy of biocontrol agents against *F. oxysporum* f. sp. *psidii*. Figures were transformed to arcsine before analysis.

| Biocontrol agents | Growth inhibition (%) |
|---------------------|-----------------------|
| <i>T. harzianum</i> | 72 |
| <i>T. hamatum</i> | 58 |
| <i>T. viride</i> | 66 |
| <i>T. virens</i> | 70 |
| <i>A. niger</i> | 40 |
| <i>G. virens</i> | 42 |
| CD ($P = 0.05$) | 1.93 |
| CV% | 1.62 |

ing test. Biocontrol agents from different areas were grown on PDA (8). Population of *Fusarium* sp. was determined by using *Fusarium* specific medium (9) by dilution plate technique (10).

The biocontrol agents were mass multiplied on sterilized (autoclaved for one hour at 1.5 kg/cm² pressure for two consecutive days) wheat bran : saw dust medium (3 : 1 + enough water to moisten) in two weeks. *In vivo* evaluation of biocontrol agents was done in pot filled with formalin (4%) sterilized soil. The biocontrol agents at 10 g/kg. soil were applied in pot soil and also added pathogen in pot soil simultaneously with antagonist. Then guava seedling were transplanted in each pot. Each treatment was replicated three times.

Average height of healthy plant, average height of diseased plant and total percentage is calculated.

$$\text{Percentage infection} = \frac{\text{Total No. of diseased plant}}{\text{Total no. of plants}} \times 100$$

Results and Discussion

T. harzianum gave maximum (72%) inhibition followed by *T. virens* (70%), *T. viride* (66%), *T. hamatum* (58%), *Gliocladium virens* (42%) and *A. niger* (40%) (Table 1).

All the six antagonists that were tested against the pathogen in post, *T. harzianum* was found to be effective against *Fusarium psidii* followed by *T. viride* and *G. virens*. Minimum percentage of infection was 6% in pots when inoculated with *T. harzianum* as compared to control (pots having *Fusarium psidii*) where percentage infection was 26% in pot conditions (Table 2) Thus there was a significant decrease in percentage infection in pots treated with the six antagonists as compared to control.

Average height of plants from healthy and diseased plants was also maximum in pots inoculated with *T. harzianum* as an antagonists.

In efficacy of biocontrol agents against *F. oxysporum* f. sp. *psidii*, *T. harzianum* is the best as height inhibitory to growth of guava against wilt pathogen (*F. oxysporum* f.sp. *psidii*) while least effective *G. virens* against pathogen. *Trichoderma* spp. (*T. harzianum*, *T. hamatum*, *T. viride*, *T. virens*) have already been reported to be highly inhibitory to the growth of *fusarium* sp. in dual culture (11).

Of the six antagonists studied for biocontrol *T. harzianum* was found to be the best for these soil fungus. *T. harzianum* is one of the most promising biocontrol agent and most frequently studied fungi reported to be efficient mycoparasite on wide range of pathogens (11–13) and also *Aspergillus niger* is efficient for soil borne pathogen (14).

Table 2. Effect of three antagonists on the biocontrol of *Fusarium* wilt of guava in the pot conditions. \pm = Standard deviation. * = Significant at $P = 0.01$, ** = Significant at $P = 0.5$, *** = Significant at $P = 0.0001$. r = correlation coefficient, T = *Trichoderma*, G = *Gliocladium*, FP = *Fusarium psidii*.

| Antagonists + Pathogen | Average height of healthy plants (cm) | Average height of diseased plants (cm) | r | Percent infection |
|---------------------------------|---------------------------------------|--|---------|-------------------|
| 1. <i>T. harzianum</i> \pm FP | 67.00 \pm 1.93 | 42.10 \pm 2.82 | - | 6 |
| 2. <i>T. hamatum</i> \pm FP | 42.00 \pm 2.34 | 39.20 \pm 2.86 | 0.896** | 17 |
| 3. <i>T. viride</i> \pm FP | 62.00 \pm 1.88 | 40.00 \pm 1.75 | 0.954** | 9 |
| 4. <i>T. virens</i> \pm FP | 63.00 \pm 1.95 | 40.10 \pm 1.75 | 0.934** | 8 |
| 5. <i>A. niger</i> \pm FP | 41 \pm 2.20 | 38.10 \pm 2.50 | 0.930** | 22 |
| 6. <i>G. virens</i> \pm FP | 42 \pm 2.00 | 39.00 \pm 2.00 | 0.921** | 18 |
| 7. <i>F. psidii</i> | 40.00 \pm 3.78 | 35.00 \pm 1.91 | 0.94*** | 26 |

However, mycoparasitism involving cell wall degrading enzymes which is proposed as an alternative hypothesis, has received less attention. Pot experiments done to control *Fusarium* wilt of guava show that *T. harzianum* is the best antagonist in controlling the wilt disease. It has been noticed that *T. harzianum* shows good mycelial growth in suitable culture under wide range of pH and temperature variance and have shown tolerance to the environmental factors during pot plant observations, therefore this fungus could be effectively used as a biocontrol in a cost effective manner.

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