Evaluation of *Trichoderma* spp. and Fungicides in the Management of Collar Rot of *Gerbera* Incited by *Sclerotium rolfsii*

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An extensive study was undertaken to manage the most vigorous, polyphagous pathogen *Sclerotium rolfsii* causing collar rot disease in *Gerbera* by utilizing nine commercial fungicides and eight novel *Trichoderma* spp. Under in vitro conditions, there was 61.11 per cent reduction of pathogen (*S. rolfsii*) by *T. harzianum* NVTH2 and *T. viride* TV1 over control and was followed by *T. citrinoviride* NVTC1, *T. citrinoviride* NVTC2 and *T. asperellum* NVT1 with per cent inhibition of 55.55, 54.44 and 53.33 respectively. On the other hand, commercial fungicides, tebuconazole 50%+ trifloxystrobin 25%, tebuconazole 250 EC, propioconazole 25% EC, fenamidone 10%+ mancozeb 50%WG and propineb 70WP reduced the growth of *S. rolfsii* to an extent of 100 per cent inhibition in all the tested concentrations. Combination of most effective *Trichoderma* spp. and fungicides had resulted in the best treatment T2 against the collar rot pathogen of *Gerbera* under protected cultivation.

**Keywords:** Fungicides, *Gerbera*, *Trichoderma* spp., collar rot.

Floriculture is recognized as a highly competitive and a profitable sector. Indian flower export markets are estimated as 11 billion US dollars at present and expected to grow up to 20 billion US dollars by 2020 (Gian Aggarwal, 2011). India has a vast potential to grow good quality *Gerbera*. Area under *Gerbera* cultivation in Tamil Nadu is around 25 ha with production of 53 lakh cut flowers at an estimated value of Rs. 15 lakhs (INDIASTAT, 2013).

There is a continuous exploitation of the soils in polyhouses which makes *Gerbera* highly susceptible to soil borne diseases. Jamwal and Jamwal (2012) observed foot rot, wilt, root rot complex, blight and grey mold in *Gerbera*. In India, collar rot disease in *Gerbera jamesonii* Bolus ex Hook was recorded for the first time caused by *Sclerotium rolfsii* (Suneeta et al., 2016).

Biological control of soil borne pathogens by using antagonistic fungi, *Trichoderma* spp. has been under investigations from several years. At the same time, chemical agents also carry the huge capacity to control the soil borne diseases with their quick mode of action. Integration of different treatments including seedling dip with carbendazim+mancozeb, addition of vermicompost, drenching with fungicide and application of *Trichoderma harzianum* (7%) were found to be effective in management of dry root rot (*Sclerotium rolfsii*) of chilli in comparison with individual treatments (Madhavi and Bhattiprolu, 2011). Seetharamulu et al. (2012) evaluated the efficacy of *Trichoderma viride* against *Fusarium solani* in *in-vitro* system while in *in-vivo* system it was effective against the disease in combination.

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with fungicide Mancozeb. Comparison of bioefficacy and combination of *Trichoderma* spp. and fungicidal molecules against collar rot pathogen (*Sclerotium rolfsii*) of *Gerbera* results in the better control of the pathogen.

**MATERIALS AND METHODS**

**Isolation of the collar rot pathogen**

The isolation technique of *Sclerotium rolfsii* was adapted from Rangaswami and Mahadevan (1999). The infected crown bits were surface sterilised by using 0.1% mercuric chloride (HgCl$_2$) for 30 seconds and placed on to the PDA medium amended with 100 ìg/ml of streptomycin sulphate which were incubated at temperature (20 ± 2°C) for 5 days.

**Identification of the pathogen**

The pathogen was identified according to the morphological characteristics based on size, shape and colour of sclerotia and mycelium growth.

**Pathogenicity test**

The mycelium and sclerotia of the pathogen *Sclerotium rolfsii* were inoculated in the collar portion of 30 days old *Gerbera* (var. Donavan yellow and Bellwater white) plants and maintained in the polyhouse at 22 ± 2°C. After 7 days of inoculation typical symptoms of browning and rotting were observed and the pathogen was re-isolated. Similar methodology was followed to prove pathogenicity in tomato plants by Xie et al. (2014).

**Collection of fungal antagonists (*Trichoderma* spp.)**

Eight isolates of *Trichoderma* spp. were collected from the Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore, India (Table 1).

**In vitro screening by *Trichoderma* spp**

The antagonistic activity of *Trichoderma* spp. against the test pathogen was evaluated by dual culture technique (Dennis and Webster, 1971). The radial growth of mycelium of antagonist in mm and pathogen were measured and Percent Inhibition (PI) was calculated: PI = C-T/C X 100

Where, C is the growth of test pathogen (mm) in the absence of the antagonist; T is the growth of test pathogen (mm) in the presence of the antagonist.

**In vitro evaluation of fungicides**

The efficacy of 9 commercial fungicides namely difenoconazole 25% EC (Score), tebuconazole 50% + trifloxystrobin 25% WG (Nativo), fenamidone 10%+mancozeb 50%WG (Sectin), propineb 70 WP (Antracol), fosetyl aluminium 50% WP (Alliete), propiconazole 25% EC (Tilt), tebuconazole 250 EC (Folicur), kresoxim-methyl 44.3% SC (Ergon) and carben-dazim 50% WP (Benfil) at 25ppm, 50ppm, 100ppm, 250ppm, 500ppm, 1000ppm and 1500ppm concentrations were tested against the root pathogens by Poisoned food technique (Grover and Moore, 1962) using Potato dextrose agar medium. The treatments were replicated thrice and were incubated at room temperature (28±2°C) and the diameter of colonies were recorded on 7th day and expressed in centimeter (cm). The per cent inhibition (PI) of growth was calculated by using the formula:

\[
PI = \frac{I}{C} \times 100,
\]

Where \(I\) = Inhibition percentage, \(C\) = Rate of growth of pathogen in control and \(T\) = Rate of growth of pathogen in treatment.

**Development of liquid formulation of *Trichoderma* spp.**

The fungal antagonists (TV1, NVTH1 and NVTH2) were cultured on 1000ml of Potato Dextrose broth and incubated in an orbital shaker at 150 rpm at room temperature (28±2°C) for 48hr. Later the liquid biomass along with fungal mycelia were mixed with 1% glycerol (10ml), tween 20 (10ml) and poly vinyl pyrrolidone – 40000 ml. wt (10g) each separately (Somasegaran and Hoben, 1985). The resultant mixture was kept in orbital shaker at 200 rpm for 5 minutes to ensure uniform blending and was standardized to obtain one ml of formulation consists of 10$^6$cfu/ml. The liquid formulation was stored at 5°C for further study.

**Integration of *Trichoderma* spp. and fungicides for the management of collar rot under protected cultivation**

Field experiment was conducted during 2013-2014 in *Gerbera* (var. Donavan yellow) fields located at Spic Agro Biotech centre, Ooty, to assess the efficacy of liquid formulation of *Trichoderma* spp. (10$^6$ cfu/ ml) @ 5ml/litre individually and in combination with commercial fungicides @ 0.5 to 1ml/lit (moderate dosages) against collar rot under protected condition (polyhouse). Thirty days old
plants of *Gerbera* were used and the experiment was laid out with 7 treatments and 3 replications in RBD. The bed size of each replication was 5m² with 30 × 30 cm spacing (Table-2).

**Statistical analysis**

All the experiments were statistically analyzed independently. The treatment means were compared by Duncan’s Multiple Range-Test (DMRT) (Gomez and Gomez, 1984). The package used for analysis was IRRISTAT version 92-1 developed by the International Rice Research Institute, Biometrics unit, The Philippines.

**RESULTS AND DISCUSSION**

**Symptomatology of collar rot**

Initially, the infected plants exhibited brown necrotic lesions on the petioles near collar region. Subsequently, the affected leaves droop and resulted in death of the infected plants. Examination showed the presence of white cottony mycelium and plenty of round, brown sclerotial bodies on the affected collar portion. Similar symptomatology was described by Arunasri *et al.* (2011) in collar rot of *Crossandra*.

**Morphological characterization of the pathogen**

Pathogen was isolated from *Gerbera* variety Donavan (yellow). The mycelium of the fungal culture on PDA medium was white and fluffy. Small white tufts were formed on mycelium which later turned to dark brown, round, sclerotia and measured 1-2 mm in diameter. Based on phenotypic characters, the pathogen was confirmed as *Sclerotium rolfsii*. Similar morphology was described by Sennoi *et al.* (2010) in the stem rot of Jerusalem artichoke (*Sclerotium rolfsii*).

**Pathogenicity of *S. rolfsii***

Inoculation of *S. rolfsii* into the collar region of 30 days old healthy *Gerbera* plants (var. Bellwater white) expressed the typical symptoms within 5 days after inoculation. Typical rot in the collar portion with numerous brown, mustard seed like sclerotia, followed by blightening and girdling of the affected plants was seen.

| S. No. | Name of isolate | Name of antagonist | Accession number of isolate in NCBI |
|-------|-----------------|--------------------|------------------------------------|
| 1. | NVTA1 | *T. asperellum* | KJ803854 |
| 2. | NVTA2 | *T. asperellum* | KJ803855 |
| 3. | NVTH1 | *T. harzianum* | KJ803856 |
| 4. | NVTH2 | *T. harzianum* | KJ803857 |
| 5. | NVTE1 | *T. erinaceum* | KJ813823 |
| 6. | NVTC1 | *T. citrinoviride* | KJ813824 |
| 7. | NVTC2 | *T. citrinoviride* | KJ813825 |
| 8. | TV1 | *T. viride* | Commercial strain (not submitted) |

**Table 2. Treatment schedule of *Trichoderma* spp. and fungicides**

| S. No. | Treatment details |
|-------|--------------------|
| 1. | RD- NVTH2+ TV1 @ 5ml/lit |
| 2. | **SD- NVTH2+ TV1 @ 5ml/lit** SD- tebuconazole 250 EC @ 500ppm |
| 3. | RD- NVTH2+ TV1 @ 5ml/lit |
| 4. | **SD- NVTH2+ TV1 @ 5ml/lit** SD- tebuconazole 50%+ trifloxystrobin 25% WG @ 500ppm |
| 5. | RD- NVTH2+ TV1 @ 5ml/lit |
| 6. | **SD- NVTH2+ TV1 @ 5ml/lit** SD-propiconazole 25% @ 500ppm |
| 7. | RD- NVTH2+ TV1 @ 5ml/lit |
| 8. | **SD- NVTH2+ TV1 @ 5ml/lit** SD- difenoconazole 25%EC @ 500ppm |
| 9. | Control |

RD- Root dipping at the time of planting; ** SD- Soil drenching at 15 days interval.
In vitro screening of Trichoderma spp. against S. rolfsii

The efficacy of in vitro antagonism of different isolates of Trichoderma spp. against S. rolfsii by dual culture technique revealed that the growth of S. rolfsii was suppressed to an extent of 61.11 per cent by T. harzianum NVTH2 and T. viride TV1 over control and was followed by T.

Table 3. Antifungal activity of Trichoderma spp. against S. rolfsii under in vitro

| S. No. | Isolates               | Mycelial growth (mm)* | Per cent Inhibition over control |
|--------|------------------------|-----------------------|---------------------------------|
| 1      | T. erinaceum-NVTE1     | 43.00                 | 52.22 (46.27)                   |
| 2      | T. citrinoviridae-NVTC1| 40.00                 | 55.55 (48.18)                   |
| 3      | T. citrinoviridae-NVTC2| 41.00                 | 54.44 (47.54)                   |
| 4      | T. asperellum-NVTA1    | 42.00                 | 53.33 (46.90)                   |
| 5      | T. asperellum-NVTA2    | 45.00                 | 49.99 (44.99)                   |
| 6      | T. harzianum-NVTH1     | 44.00                 | 51.11 (45.63)                   |
| 7      | T. harzianum-NVTH2     | 35.00                 | 61.11 (51.42)                   |
| 8      | T. viride (TV1)        | 35.00                 | 61.11 (51.42)                   |
| 9      | Control                | 90.00                 | -                               |

*Values are mean of three replications.
In a column, means followed by a common letter are not significantly different at the 5% level by DMRT
Values in parentheses are arc sine transformed values

Table 4. In vitro antagonism of fungicides against S. rolfsii

| S. No. | Fungicides             | Per cent inhibition over control |
|--------|------------------------|---------------------------------|
|        |                        | 25ppm  | 50ppm  | 100 ppm | 250 ppm | 500 ppm | 1000 ppm | 1500 ppm |
| 1      | Tebuconazole 250EC     | 86.67  | 100    | 100     | 100     | 100     | 100      | 100       |
|        |                        | (68.32)| (89.53)| (89.53) | (89.53) | (89.53) | (89.53)  | (89.53)   |
| 2      | Propiconazole 25EC     | 100    | 100    | 100     | 100     | 100     | 100      | 100       |
|        |                        | (89.53)| (89.53)| (89.53) | (89.53) | (89.53) | (89.53)  | (89.53)   |
| 3      | Difenoconazole 25EC    | 70     | 74.44  | 78.89   | 86.67   | 100     | 100      | 100       |
|        |                        | (57.18)| (59.51)| (62.43) | (68.6)  | (89.53) | (89.53)  | (89.53)   |
| 4      | Fenamidone 10%+Mancozeb50%WG | 100 | 100 | 100     | 100     | 100     | 100      | 100       |
|        |                        | (89.53)| (89.53)| (89.53) | (89.53) | (89.53) | (89.53)  | (89.53)   |
| 5      | Propineb70WP           | 80     | 83.33  | 88.89   | 100     | 100     | 100      | 100       |
|        |                        | (63.91)| (65.91)| (69.74) | (89.53) | (89.53) | (89.53)  | (89.53)   |
| 6      | Fosetyl aluminium 50%WP| 0      | 0      | 0       | 0       | 0       | 0        | 0         |
|        |                        | (0.46)|(0.46) |(0.46)   |(0.46)  |(0.46)  |(0.46)    |(0.46)     |
| 7      | Kresoxim-Methyl 44.3%SC | 4.44  | 7.78   | 16.67   | 20      | 23.33   | 40       | 42.22     |
|        |                        | (12.01)| (15.7) | (24.27) | (27.03) | (28.87) | (39.42)  | (40.45)   |
| 8      | Tebuconazole 50%Trifloxystrobin25%WG | 100 | 100 | 100     | 100     | 100     | 100      | 100       |
|        |                        | (89.53)| (89.53)| (89.53) | (89.53) | (89.53) | (89.53)  | (89.53)   |
| 9      | Carbendazim 50%WP      | 0      | 0      | 0       | 0       | 0       | 8.89     | 13.33     |
|        |                        | (0.46)|(0.46) |(0.46)   |(0.46)  |(0.46)  |(16.75)   |(21.55)    |
| 10     | Control                | 0      | 0      | 0       | 0       | 0       | 0        | 0         |
|        |                        | (0.46)|(0.46) |(0.46)   |(0.46)  |(0.46)  |(0.46)    |(0.46)     |

*Values are mean of three replications. **SD-soil drenching at 15 days interval.
In a column, means followed by a common letter are not significantly different at the 5% level by DMRT
Values in parentheses are arc sine transformed values
Table 5. Effect of *Trichoderma* spp. and fungicides on collar rot incidence, growth characters and flower yield under protected cultivation

| S. No. | Treatment module | Collar rot incidence* | Root length (cm)* | Plant height (cm)* | No. of flowers/m²* |
|--------|------------------|-----------------------|-------------------|-------------------|-------------------|
| T₁     | RD-NVTH2+ TV1 @5ml/lit | 4.30 (56.52)          | 20.23a             | 41.46b             | 50.10b            |
|        | **SD- NVTH2+ TV1 @5ml/lit+SD-tebuconazole 250 EC @500ppm** | | | | |
| T₂     | RD-NVTH2+ TV1 @5ml/lit | 4.00 (59.55)          | 20.40a             | 42.11a             | 51.80a            |
|        | **SD- NVTH2+ TV1 @5ml/lit+SD-tebuconazole 50%+trifloxistrobin 25% WG @500ppm** | | | | |
| T₃     | RD-NVTH2+ TV1 @5ml/lit | 5.53 (45.99)          | 19.22b             | 39.20c             | 48.60c            |
|        | **SD- NVTH2+ TV1 @5ml/lit+SD-propioconazole 25% @500ppm** | | | | |
| T₄     | RD-NVTH2+ TV1 @5ml/lit | 6.11 (38.22)          | 18.12c             | 37.23c             | 46.10d            |
|        | **SD- NVTH2+ TV1 @5ml/lit+SD-propineb 70 WP @500ppm** | | | | |
| T₅     | RD-NVTH2+ TV1 @5ml/lit | 5.69 (42.46)          | 18.70e             | 38.27d             | 47.30d            |
|        | **SD- NVTH2+ TV1 @5ml/lit+SD-fenamidine 10%+mancozeb 50% WG @500ppm** | | | | |
| T₆     | RD-NVTH2+ TV1 @5ml/lit | 7.91 (20.02)          | 17.82d             | 36.71d             | 45.20f            |
|        | **SD- NVTH2+ TV1 @5ml/lit+SD-difenoconazole 25%EC @500ppm** | | | | |
| T₇     | RD-NVTH2+ TV1 @5ml/lit**SD- NVTH2+ TV1 @5ml/lit** | 8.23 (16.78)          | 17.22d             | 36.36f             | 44.10d            |
| T₈     | Control | 9.89f | 16.83f | 34.69g | 39.30h |

*Values are mean of three replications. **SD-soil drenching at 15 days interval
Means followed by a common letter are not significantly different at 5% level by DMRT
Data in the parenthesis are per cent reduction over control
Table 6. Effect of Trichoderma spp. and fungicides on flower characters of *Gerbera* under protected cultivation

| S. No. | Treatments                                                                 | Days taken for flower bud initiation* | Days taken for flower bud opening* | Length of flower stalk (cm)* | Flower diameter (cm)* |
|--------|-----------------------------------------------------------------------------|---------------------------------------|-----------------------------------|-----------------------------|-----------------------|
| T₁     | RD-NVTH2+ TV1 @5ml/lit **SD- NVTH2+ TV1 @5ml/lit+SD-tebuconazole 250 EC @500ppm | 83.40<sup>b</sup>                      | 106.00<sup>c</sup>                | 36.20<sup>c</sup>           | 8.80<sup>b</sup>       |
| T₂     | RD-NVTH2+ TV1 @5ml/lit **SD- NVTH2+ TV1 @5ml/lit+SD-tebuconazole 50%+trifloxistrobin 25% WG @500ppm | 81.10<sup>a</sup>                      | 104.33<sup>a</sup>                | 36.40<sup>b</sup>           | 9.00<sup>a</sup>       |
| T₃     | RD-NVTH2+ TV1 @5ml/lit **SD- NVTH2+ TV1 @5ml/lit+SD-propioconazole 25% EC @500ppm | 84.00<sup>c</sup>                      | 107.66<sup>cd</sup>               | 35.60<sup>ef</sup>          | 8.60<sup>c</sup>       |
| T₄     | RD-NVTH2+ TV1 @5ml/lit **SD- NVTH2+ TV1 @5ml/lit+SD-propineb 70 WP@500ppm | 85.66<sup>d</sup>                      | 110.00<sup>f</sup>                | 34.80<sup>gh</sup>          | 8.00<sup>e</sup>       |
| T₅     | RD-NVTH2+ TV1 @5ml/lit **SD- NVTH2+ TV1 @5ml/lit+SD-fenamidone 10%+mancozeb 50% WG@500ppm | 86.20<sup>e</sup>                      | 108.00<sup>de</sup>               | 35.90<sup>ef</sup>          | 8.40<sup>d</sup>       |
| T₆     | RD-NVTH2+ TV1 @5ml/lit **SD- NVTH2+ TV1 @5ml/lit+SD-difenoconazole 25% EC @500ppm | 88.30<sup>f</sup>                      | 112.00<sup>df</sup>               | 34.60<sup>gh</sup>          | 7.90<sup>h</sup>       |
| T₇     | RD-NVTH2+ TV1 @5ml/lit **SD- NVTH2+ TV1 @5ml/lit+SD-fenamidone 10%+mancozeb 50% WG@500ppm | 90.10<sup>g</sup>                      | 115.33<sup>gh</sup>               | 34.40<sup>hi</sup>          | 7.80<sup>gh</sup>      |
| T₈     | Control                                                                    | 92.33<sup>b</sup>                      | 119.00<sup>de</sup>               | 32.20<sup>e</sup>           | 7.10<sup>ef</sup>      |

*Values are mean of three replications

Means followed by a common letter are not significantly different at 5% level by DMRT
citrinoviride NVTC1, T. citrinoviride NVTC2 and T. asperellum NVTA1 with per cent inhibition of 55.55, 54.44 and 53.33 respectively (Table-3).

Manu et al. (2012) observed the maximum inhibition of mycelial growth of 61.88% in T. harzianum, which was followed by T. viride (Tv-27 isolate) (57.77%) and T. harzianum (Tv-55 isolate) (56.33%) against S. rolfsii causing foot rot of finger millet. Patro and Madhuri (2013) evaluated the antagonistic effect of biocontrol agents viz., T. harzianum - 1, T. harzianum – 2, T. viride, Pseudomonas fluorescens and Bacillus subtilis against S. rolfsii causing foot rot of finger millet and observed maximum inhibition of mycelial growth (61.88%) in T. harzianum - 2, which was followed by T. viride (57.77%).

In vitro screening of fungicides against S. rolfsii

Among the nine fungicides, tebuconazole 50%+ trifloxystrobin 25%, tebuconazole 25% EC, propiconazole 25% EC, fenamidone 10%+mancozeb 50%WG and propineb70WP recorded 100 per cent inhibition of pathogen growth in all the concentrations tested. Difenoconazole 25% EC recorded 100 per cent inhibition of pathogen at 500, 1000 and 1500ppm concentrations. Other fungicides like carbendazim 50%WP, fosetyl aluminium 80%WP and kresoxim-methyl 44.3% SC were not so effective in inhibiting the mycelial growth of S. rolfsii (Table-4).

Arunasri et al. (2011) reported that the combi products containing triazoles viz., avatar, merger and nativo were highly inhibitive to the growth of Sclerotium rolfsii in crossandra. Sangeetha and Jahagirdar (2013) reported that mancozeb, carbendazim, thiophanate methyl, hexaconazole, propiconazole completely inhibited the growth of S.rolfsii, R. bataticola and Fusarium sp. causing root rot and wilt complex in soybean.

Effect of Trichoderma spp. and fungicides on management of collar rot and plant growth promotion of Gerbera

Field experiment resulted in T, as best treatment module in reducing collar rot incidence, growth and yield parameters of Gerbera which was a combination of most effective Trichoderma spp. strains @ 5ml/lit and commercialized combi fungicide, Nativo @ 0.5ml/lit applied at 10ml/plant in the polyhouse. This was followed by treatment T, which was significantly effective against collar rot disease and improved the plant growth parameters of Gerbera either over the control (Table 5 & 6).

Triazole compounds are generally used as fungicides for the management of both soil borne and foliar diseases of crop plants, which also have plant growth regulating properties (Fletcher et al., 1986). In the triazole fungicide (difenoconazole), thirteen novel triazole analogs containing 1, 3-dioxolane rings have been synthesized and they express plant-growth regulatory activity similar to those of a difenoconazole (Xu et al., 2004).

There are several reports demonstrating control of a wide range of plant pathogens including Sclerotium rolfsii by Trichoderma spp. by elicitation of induced systemic or localized resistance which occur due to the interaction of bioactive molecules such as proteins avr-like proteins and cell wall fragments released by the action of extracellular enzymes during mycoparasitic reaction (Thangavelu & Mustaffa, 2010). The possible mechanisms involved in the reduction of collar rot severity of Gerbera due to Trichoderma spp. treatment might be the mycoparasitism, spatial and nutrient competition, antibiosis by enzymes and secondary metabolites, and induction of plant defense system.

Integration of different treatments like carbendazim+metalaxyl, captan+ metalaxyl+ G. virens 3 and captan+ metalaxyl+ T. viride 2 was confirmed as higher disease reduction of wilt complex caused by four wilt pathogens viz, Fusarium oxysporum, Phytophthora capsici, Rhizoctonia solani and Sclerotium rolfsii to 59.8, 58.6 and 58.0 % over control and maximum yield of 138.6, 137.0 and 135.6 q/ha was observed respectively in Bell pepper (Rather et al., 2012).

Hence, the combination of the efficient Trichoderma spp. and fungicidal molecules resulted in the collar rot disease reduction significantly and subsequently increased the plant growth parameters in Gerbera jamesonii.

Conclusion

S. rolfsii is a polyphagous, highly vigourous and destructive soil borne pathogen and is a difficult task to control this pathogen once established. This study was undertaken to obtain the efficient strains of Trichoderma spp. and the effective fungicides in order to get a novel integrated management module against the...
most destructive collar rot pathogen of Gerbera under polyhouse. This occurrence of collar rot in Gerbera jamesonii is a first report in Tamil Nadu, India. This might be due to the unknowing transmission of propagules through implements and tools used in the soils of polyhouse.

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