Vegetables are an important source of essential vitamins, minerals and crude fibres required for human health. Tomato and brinjal are two most important and solanaceaeous vegetable crop in the world. Most of the vegetable crops are raised through seedlings in open nursery beds. However, soil-borne diseases are very difficult problem in raising a successful nursery. Several soil-borne pathogen cause heavy losses not only in nursery but also in field after transplantation. Among these diseases damping-off caused by *Pythium aphanidermatum* (Edson) Fitz. is a major seedling problem in vegetables particularly tomato and brinjal and it is not possible to protect the seedlings for the entire susceptible period by the use of conventional non systemic fungicide (Singh, 1978).

Generally damping-off causes total failure of vegetable nursery chemical control of this pathogen is not economical because of high cost, resistance, environmental pollution and deleterious effect to non target beneficial soil microorganisms. Thus biological control using antagonists and cultural practices offer a practical and economical alternative for management of this disease. *Thrichoderma* species have been reported to be highly effective against damping-off caused by *Pythium* species (Mukherjee, P.K.et. al., 1989, Sivam, A., Elad, Y. and Chet, I., 1984,. Sawant,. I. S. and Mukhopadhyay, A.N. 1990)

The success achieved in the control of damping-off disease by fungal antagonists, either alone (Fajola and Alasoadura, 1975) or in
combination with fungicides (Papavizas, 1985) aware us to take up the project entitled “Studies on management of damping-off of vegetables caused by *Pythium aphanidermatum* (Edson) Fitz. using cultural practices and antagonists”. We tested the antagonism and biocontrol efficacy using *Trichoderma* species, cultural practices through different sowing dates soil solarization, using organic amendments like Neem Cake, Mustard Cake, Mahua Cake and Neem oil formulations, used herbal extracts from leaves, rhizome, root, clove, bulb etc. against *P. aphanidermatum in vitro* and *in vivo*.

For study on damping-off disease of tomato and brinjal in nursery beds, various experimental attempts were made. The major findings of this project are summarised as under-

1. The symptoms of the disease were characterized in nursery stage in pre-emergence and post-emergence types. In pathogenic damping-off, there were water-soaked discoloured spots observed at the infection sites, on the stem (near ground level). In pre-emergence stage young seedlings were killed before they emerge out of the soil surface. In post-emergence stage, the infected stem tissues appeared soft and water-soaked leading to the toppling of the seedlings over the soil surface.

2. *Pythium aphanidermatum* was isolated from the infected seedlings and infested soil collected from all nine blocks of Faizabad district. The morphological characters of the test fungus were studied after purification on C.D.A. medium. The mycelium was irregularly branched, coenocytic but later septate and the filaments full of granular protoplasm. The fungus produced zoospores (bicilliate
and reniform), oogonia (smooth walled, terminal), antheridia (intercalary and short) and oospores (aplerotic smooth and thick walled).

3. Koch's postulate proved positive and revealed that the pathogen responsible for damping-off disease of both target vegetables was *Pythium aphanidermatum* (Edson) Fitz.

4. Varieties/germplasm/lines of tomato and brinjal each had been tested for the reaction to the related pathogen following sick-pot culture technique on the basis of "CODEX" value as suggested by Steal and Torrie (1981)

(a) In sick-pot technique, out of 50 varities/germplasm/lines of tomato five were resistant viz., S-24, Richa F₁ hybrid, Roma, Columbia and H-110; three moderately resistant viz, Trisha F₁, hybrid, H-57, NDTV-73, twenty seven susceptible viz. Narendra tomato-1, (NDT-5), NDTV-3, NDTV-11 NDTV-60, NDTV-44-1, H-36, Co-3, SEL-7, HVT-1, Kanchan, kanheri-55, Navodya, Boss-F₁ hybrid, Rupali, F₁ hybrid, Arjun F₁ hybrid, Sel-1, Punjab Chhuhara, Sel-7, H-101, Acc-99, Sel-2, H-21, H-31, H-52, P-18, H-27, H-29 and rest all were either susceptible or highly susceptible to *Pythium aphanidermatum*.

(b) In brinjal, under natural condition, none was found immune and highly resistant four were resistant, ten moderately resistant, seven moderately susceptible, fifteen susceptible and fourteen highly susceptible against *P. aphanidermatum*.
5. Five fungicides viz.; Carbendazim, Dithane M-45, Thiram, Corboxin and kavach were tested *in vitro* against *P. aphanidermatum* following poisoned food technique:

(a) Carbendazim 500 ppm, Dithane M-45 500 ppm. Thiram 1500 ppm, Carboxin 1000 ppm and Kavach 1000 ppm. completely inhibited the mycelial growth of *P. aphanidermatum*. Testing of these fungicides, *in vivo* through seed treatment with all the five selected fungicides @ 0.2%, carbendazim and dithane M-45 found effective against the test pathogen, The minimum damping-off incidence was obtained in case of carbendazim and least effectiveness in Kavach.

6. Bioagents (*Trichoderma harzianum* and *Trichoderma viride*) were isolated from Bikapur, Maya, Pura, Haranteenganj, Tarun, Sohawal, Milkipur, Masaudha, Amaniganj Blocks and tested for their efficacy against *P. aphanidermatum in vitro* following dual culture technique.

(a) Three different isolates (M, H and P) from Milkipur, Haranteenganj and Pura of bioagents respectively were found effective against *P. aphanidermatum in vitro*.

(b) *T. viride* was found superior rather than *T. harzianum*. *T. viride*-M showed maximum seedling germination (67.0%) followed by *T. viride*-H (66.0%) in tomato. However *T. harzianum*-M was highly effective showing 74.0% seedling germination followed by *T. harzianum*-H, 71.5% in pot culture.
(c) The Milkipur isolate (native) of *T. harzianum* and *T. viride* was more effective in inhibiting the mycelial growth of *P. aphanidermatum* as compared to Haranteenganj and Pura isolates.

(d) No significant difference in mycelial inhibition was observed in both fungal antagonists from Haranteenganj and Pura.

(e) The fungal antagonist *T. harzianum* was applied as seed and soil treatment. It did not seem to be ineffective in the present study in reducing damping-off. However, seed treatment with *T. harzianum* performed better in checking the seedling disease than its soil application.

(f) Both antagonists, *T. viride* and *T. harzianum* were used for soil and seed treatment to find their potential effectiveness against *Pythium* damping-off. Observations on mortality of tomato seedling showed *T. viride* at par with *T. harzianum* and carbendazim. However, in brinjal, *T. harzianum* was at par with *T. viride* and Carbendazim although soil treatment less effective than seed treatment.

(g) Effect of sowing dates and chemical treatments together observed by two ways. One as the sowing of tomato and brinjal seeds in damping-off sick-pot and other by dipping the seed in fungicide solution.

7. (a) In tomato, interaction of sowing date (*S*₁-6 August) with carbendazim (0.1%) showed highest disease control (98.86%) and lowest with sowing date (*S*₂-21 August) and
Kavach (0.2%) was 36.42%.

(b) In other treatment with brinjal, carbendazim was found as the best effective treatment sowing on 5th July with significant damping-off control (97.85%). The minimum control (34.70%) was recorded with Kavach treated seed on similar date of sowing.

8. Effect of soil solarization alone or in integration with bioagent, chemicals and organic amendments were evaluated. The soil solarization alone had been observed showing 68.97% and 67.53% seed germination in tomato and brinjal respectively. This treatment (SS) with *T. harzianum* (ST) had been recorded the highest (83.22%) seed germination followed by SS + ST - carbendazim (81.0%).

9. Organic amendments viz., neem cake, mustard cake, mahua cake and FYM were inoculated against damping-off disease of tomato and brinjal at different doses.

(a) Per cent healthy seedlings were observed about similar in all except in Mahua Cake.

(b) Among the four amendments FYM was significantly superior showing mean healthy seedlings (68%) over others.

10. Fifty herbal plants from the locality had been listed as source of their extracts from different plant parts. Among these ten herbal plants were found highly effective, therefore, selected for *in vitro* and *in vivo* testing.

(a) The maximum per cent seed germination was observed with
(Azadirachta indica, Allium cepa and Adhatoda vasica and minimum pathogen recovery (1.1%) with Allium sativum followed by Azadirachta indica (1.2%).

(b) In vivo studies based on these ten effective phytoextracts, it was observed that the leaf extracts of Azadirachta indica caused maximum inhibition next to Allium sativum.