EXPLANATION OF FIGURES AND PLATES
Fig. 1. *Bacillus* var. *mycoides B-44:
A. Vegetative cells (on nutrient agar) 24 hrs. old.
B. Vegetative cells (on glucose agar) 24 hrs. old.
C. Premature endospores (gram stain).
D. Mature endospores (spore stain).

Fig. 2. *Nocardia A-15:
A. Aerial mycelium.
B. Vegetative mycelium.
C. Aerial mycelium with catenulate and spiralled sporophores.
D. Mature spores.

Fig. 3. *Nocardia A-71:
A. Aerial mycelium with sporophores.
B. Clusters of sporophores.
C. Aerial mycelium with sporophore.
D. Mature spores.
E. Branched chain of spores formed by fragmentation of aerial mycelium.

Fig. 4. *Claviceps A-44:
A. Aerial mycelium bearing sporophores.
B. Vegetative mycelium.
C. Sporophores.
D. Mature spores.
Fig. 5. *S. flavovirens* GA-1:
A. Aerial mycelium with sporophores.
B. Vegetative mycelium.
C. Sporophores.
D. Mature spores.

Fig. 6. *S. bikiniensis* A-81:
A. Sporophores.
B. Aerial mycelium with sporophores.
C. Mature spores.

Fig. 7. *S. bikiniensis* A-26:
A. Sporophores.
B. Mycelium bearing hooked and open loop types of sporophores.
C. Mature spores.

Fig. 8. *S. bikiniensis* A-31:
A. Vegetative mycelium.
B. Sporogenous aerial mycelium bearing flexuous type of sporophore.
C. Mature spores.
Fig. 9. *S. cyanescens* CA-3:
A. Aerial mycelium with cluster of sporophores.
B. Vegetative mycelium.
C. Sporophores.
D. Mature spores.

Fig. 10. *S. virgatus* A-1:
A. Cluster of sporophores.
B. Sporogenous aerial mycelium bearing chains of oidiospores.
C. Catenulate oidiospores.

Fig. 11. *S. globisporus* CA-2:
A. Aerial mycelium bearing clusters of sporophores.
B. Vegetative mycelium.
C. Cluster of sporophores.
D. Sporophore.
E. Sporogenous aerial mycelium forming branched chain of spores.

Fig. 12. *S. globisporus* A-69:
A. Aerial mycelium.
B. Vegetative mycelium.
C. Sporogenous aerial mycelium bearing caténulate spores.
D. Mature spores.
Fig. 13. *Streptomycetes* sp. CA-5:
A. Aerial mycelium.
B. Vegetative mycelium.
C. Sporangia aerial mycelium.
D. Sporophore.
E. Mature spores.

Fig. 14. *Streptomycetes* sp. A-70:
A. Sporangia aerial mycelium.
B. Vegetative mycelium.
C. Sporophore.
D. Mature spores.

Fig. 15. *Streptomycetes* sp. A-10:
A. Aerial mycelium.
B. Sporangia aerial mycelium.
C. Sporophore.
D. Mature spores.

Fig. 16. *Streptomycetes* sp. A-30:
A. Sporangia aerial mycelium bearing spiralled sporophores.
B. Vegetative mycelium.
C. Sporophore.
D. Mature spores.
Figures 13-16.
Fig. 17. *Streptomyces* sp. A-47:
A. Cluster of spiralled sporophores.
B. Aerial mycelium bearing sporophores.
C. Sporophore.
D. Mature spores.

Fig. 18. *C. trilatexala* F-75:
A. Perithecium.
B. Terminal hair.
C. Spores.

Fig. 19. *P. flavescens* F-82:
A. Funiculose mycelium bearing phialides with chains of spores.
B. Funiculose mycelium with phialides.
C. Mature spores.

Fig. 20. *A. terraeus* var. *aurana* F-79:
A. Conidial head with foot cells.
B. Spores.

Fig. 21. *A. candidus* F-81:
A. Conidial head.
B. Foot cell.
C. Mature spores.
A. Spray apparatus:
   A. Cotton wool.
   B. Air tube.
   C. Tube for microbial suspension.

B. Primary screening:
   Inhibition zones formed by bacteria, actinomycetes and fungi against \textit{B. subtilis} which was inoculated by spray.

C. Primary screening of fungi and actinomycetes.
   Test organism \textit{B. subtilis}.

D. Antagonistic activity of \textit{S. globisporus} GA-2 against \textit{P. solanacearum} (Ps), \textit{E. coli} (Ec) and \textit{B. subtilis} (Bs).

E. Antibacterial activity of \textit{P. harquei} (Ph) against \textit{B. subtilis} (Bs), \textit{P. solanacearum} (Ps) and \textit{A. temefacien} (At).
Plate - II.

A. Antimicrobial activity of *B. cereus* var. *mycoides* B-44 against *O. graminis* (0g).

B. Antifungal activity of *B. cereus* var. *mycoides* B-44 against *P. ultimum* PF-12.

C. Antifungal activity of *S. anulatus* A-71 against *S. apicifera* (Cs).

D. Antimicrobial activity of *S. anulatus* A-71 against *P. ultimum* PF-12.

E. Antifungal activity of *S. anulatus* A-71 against *E. culmorum* (Fc).

F. Activity of *S. anulatus* A-71 against *E. solani* strain II (RsII).
Plate - III.

A. Antifungal activity of *S. anulatus* A-71 against *Q. graminia* (0g).

B. Antifungal activity of *S. erythraeus* A-15 against *T. viride* T-17.

C. Antifungal activity of *S. erythraeus* A-15 against *R. solani* I. (RsI).

D. Activity of *S. erythraeus* A-15 against *R. solani* II. (RsII).

E. Activity of *S. erythraeus* A-15 against *P. ultimum* PF-12.

F. Activity of *S. erythraeus* A-15 against *R. sorokiniana* (=*H. sativum*) (Bs).
Plate - IV.

A. Antifungal activity of *S. bikiniensis* A-26 against *O. graminis* (Og).

B. Activity of *S. bikiniensis* A-26 against
*E. sorokiniana* (=*H. sativum*) (Ss).

C. Antibacterial activity of *S. bikiniensis* A-31 against *S. aureus* (Sa), *E. cerus* (Ec) and
*S. lutea* (Sl).

D. Antifungal activity of *S. bikiniensis* A-31 against *P. ultimum* PF-12.

E. Antibacterial activity of *S. flavescens* A-44 against *E. cerus* (Ec), *S. lutea* (Sl) and
*S. aureus* (Sa).

F. Antifungal activity of *S. flavescens* A-44 against *P. parasitica* var. *nigrina* (Pp).
Plate - V.

A. Antifungal activity of *S.flaveolus* A-44 against *P. ultimum* PF-12.

B. Inhibitory zone formed by *S.flaveolus* A-44 against *B.sorokiniana* (=*H.sativum*) (Bs).

C. Antifungal activity of *S.flaveolus* A-44 against *P.gulmorum* (Fc).

D. Activity of *S.flaveolus* A-44 against *O.graminis* (0g).

E. Antifungal activity of *S.flaveolus* A-44 against *C.spicifera* (Cs).

F. Antifungal activity of *S.flaveolus* A-44 against *T.terricola* (Tt).
A. Antibacterial activity of *S. flavovirens* GA-1 against *B. cereus* (Be), *S. aureus* (Sa) and *S. lutea* (Sl).

B. Antifungal activity of *S. flavovirens* GA-1 against *F. culmorum* (Fc).

C. Antifungal activity of *S. flavovirens* GA-1 against *F. ultimum* PF-12.

D. Activity of *S. flavovirens* GA-1 against *G. singulata* (Ge).

E. Antibacterial activity of *Streptomyces* sp. GA-5 against *S. aureus* (Sa) and *S. lutea* (Sl).

F. Antibacterial activity of *S. virgatus* A-1 against *F. solanacearum* (Ps), *E. coli* (Ec) and *A. tumefaciens* (At).
A. Antibacterial activity of *S. globisporus* A-69 against *B. sereus* var. *mycoides* B-44, *B. subtilis* (Bs) and *P. solanacearum* (Ps).

B. Antifungal activity of *S. globisporus* A-69 against *C. spicifera* (Cs).

C. Antifungal activity of *S. globisporus* A-69 against *O. graminis* (Og).

D. Activity against *E. culmorum* (Fc) by *S. globisporus* A-69.

E. Activity of *C. trilaterale* F-75 against gram negative bacteria, *P. solanacearum* (Ps), *A. tumefaciens* (At) and *E. coli* (Ec).

F. Antimicrobial activity of *C. trilaterale* F-75 against gram positive bacteria, *B. sereus* var. *mycoides* B-44, *B. subtilis* (Bs) and *Micrococcus* sp. (M).
Plate - VIII.

A. Antifungal activity of *C. trilatereale* F-75 against *P. ultimum* PF-12.

B. Antifungal activity of *C. trilatereale* F-75 against *E. culmorum* (Fc).

C. Activity of *C. trilatereale* F-75 against *Alternaria* sp. (A).

D. Antimicrobial activity of *C. trilatereale* F-75 against *S. aureus* (Sa), *B. cereus* (Bc) and *B. lutea* (Sl).

E. Antifungal activity of *C. trilatereale* F-75 against *B. solani* -strain II (RsII).

F. Antifungal activity of *C. trilatereale* F-75 against *B. sorokiniana* (=*H. sativum*) (Bs).
Plate - IX.

A. Antifungal activity of *A. terreus* var. *aureus* F-79 against *T. terricola* (Tt).

B. Antibacterial activity of *A. terreus* var. *aureus* F-79 against *B. cereus* (Bc), *S. aureus* (Sa) and *S. lutea* (Sl).

C. Activity of *A. terreus* var. *aureus* F-79 against *G. lunata* (Gl), *G. singulata* (Gc) and *Alternaria* sp. (A).

D. Antibacterial activity of *A. terreus* var. *aureus* F-79 against *B. subtilis* (Bs), *P. solanacearum* (Ps) and *A. tumefaciens* (At).

E. Antibacterial activity of *A. candidus* F-31 against *B. cereus* (Bc), *S. aureus* (Sa) and *S. lutea* (Sl).

F. Antifungal activity of *A. candidus* F-31 against *B. sorokiniana* (=*H. sativum*) (Bs).
Plate – X.

A. Antifungal activity of *A. candidus* F-S1 against *P. ultimum* PP-12.

B. Activity of *A. candidus* F-S1 against gram positive bacteria, *E. cereus* (Ec), *S. aureus* (Sa) and *S. lutea* (Sl).

C. Antifungal activity of *A. candidus* F-S1 against *G. lunata* (Cl), *G. cingulata* (Ge) and *Alternaria* sp. (A).

D. Antibacterial activity of *A. candidus* F-S1 against *E. subtilis* (Bs), *P. solanacearum* (Ps) and *A. tumefaciens* (At).

E. Antifungal activity of *A. candidus* F-S1 against *E. solani* strain I (EsI).

F. Antifungal activity of *A. candidus* F-S1 against *E. arokiniana* (=*H. sativum*) (Es).
A. **Antifungal activity of culture filtrates from**
   *B. cereus* var. *mycoides* B-44 against test organism *C. lunata*:
   1. Culture filtrates from Stessel et al. medium E (10th day)
   2. Culture filtrates from Stessel at al. medium A (10th day).

B. **Antibiotic activity of culture filtrates from**
   *B. cereus* var. *mycoides* B-44 against test organism *B. subtilis*:
   1. Culture filtrates from potato dextrose broth (2nd day)
   2. Culture filtrates from molasses medium (2nd day).

C. **Antifungal activity of culture filtrates from**
   *S. erythraeus* A-15 against test organism *C. lunata*:
   1. Culture filtrates from molasses medium (6th day)
   2. Culture filtrates from potato dextrose broth (2nd day).

D. **Antibacterial activity of culture filtrate from**
   *S. erythraeus* A-15 against test organism *B. subtilis*:
   1. Culture filtrates from molasses medium (6th day)
   2. Culture filtrates from potato dextrose broth (2nd day).

E. 1. Antifungal activity of culture filtrate, from molasses medium, of *S. anulatus* A-71 against *C. lunata* (4th day).

F. Antifungal activity of culture filtrates from *S. anulatus* A-71 against test organism *C. lunata*:
   1. Culture filtrates from molasses medium (8th day)
   2. Culture filtrates from potato dextrose broth (8th day).
A. 1. Antibacterial activity of culture filtrates, from molasses medium, of *S. bikiniensis* A-81 against *B. subtilis* (4th day).

2. Activity of culture filtrates, from molasses medium, of *S. bikiniensis* A-26 (4th day).

B. 1. Antibacterial activity of culture filtrates, from molasses medium, of *S. bikiniensis* A-81 against *B. subtilis* (2nd day).

2. Activity of culture filtrates, from molasses medium, of *S. bikiniensis* A-26 (2nd day).

C. 1. Antifungal activity of culture filtrates, from molasses medium, of *S. anulatus* A-71 (4th day).

2. Antifungal activity of culture filtrates, from molasses medium, of *S. flavovirens* GA-1 (4th day).

D. Activity of culture filtrates of *S. flavovirens* GA-1 against test organism *C. lunata*:
   1. Culture filtrates from molasses medium (6th day).
   2. Culture filtrates from potato dextrose broth (2nd day).

E. Activity of culture filtrates, from gliotoxin fermentation medium, of *S. trilatereale* F-75 against test organism *B. subtilis* (6th day).

F. 1. Antibacterial activity of culture filtrates, from potato dextrose broth, of *S. trilatereale* F-75 (4th day).

2. Activity of culture filtrates, from potato dextrose broth, of *T. virida* T-10 (4th day).
A. Antibacterial activity of culture filtrates, from gliotoxin fermentation medium, of *T. viride* T-10 (4th day).

B. 1. Antibacterial activity of culture filtrates, from potato dextrose broth, of *A. terreus* var. *Aureus* F-79 (2nd day).

   2. Activity of culture filtrates, from potato dextrose broth, of *T. viride* T-10 (6th day).

C. Antibacterial activity of culture filtrates, from potato dextrose broth, of *A. terreus* var. *Aureus* F-79 (10th day).

D. 1. Antibacterial activity of culture filtrates, from potato dextrose broth, of *A. candidas* F-81 (8th day).

   2. Antibacterial activity of culture filtrates, from potato dextrose broth, of *P. flavescens* F-82 (8th day).

E. 1. Antifungal activity of culture filtrates, from potato dextrose broth, of *A. candidas* F-81 (12th day).

   2. Controls.

F. 1. Activity of culture filtrates, from Stessel et al. medium D, of *S. hikiniensis* A-81 (4th day).

   2. Antibacterial activity of culture filtrates, from Czapek-Dox + yeast extract broth, of *P. flavescens* F-82 (4th day).

   3. Activity of culture filtrates, from Stessel et al. medium D, of *S. hikiniensis* A-26 (4th day).
A. Antibiotic effect due to culture filtrates from
   *B. cereus* var. *mycoides* B-44 on the germination
   of spores of *G. lunata* (see abnormal development
   of germ tubes into balloon like structures).

B. Abnormal hyphal development in *G. lunata* due to
   antibiotic effects of culture filtrates
   from *B. cereus* var. *mycoides* B-44.

C. Cross-antagonism:
   Activity of *B. cereus* var. *mycoides* B-44
   against *S. flavovirens* CA-1, *S. globisporus*

D. Activity of *S. erythraeus* A-15 against its own
   population (Isoantagonism) and *A. candidus* F-81.

E. Cross-antagonistic activity of *S. erythraeus* A-15
   against *T. viride* T-10.

F. Cross-antagonistic activity of *S. anulatus* A-71
   against *T. viride* T-10.

B. Activity of *S. bikiniensis* A-26 against
   
   *S. globiosporus* A-69, *S. flavovirens* GA-1,  
   *S. flav expired* A-44 and *A. terreus* var. *aureus* F-79.

C. Activity of *S. bikiniensis* A-26 against
   
   *S. bikiniensis* A-81, *S. anulatus* A-71 and  
   *S. erythraeus* A-15.


E. Activity of *S. flavovirens* GA-1 against
   
   *A. terreus* var. *aureus* F.79 and  
   *G. trilaterale* F-75.

F. Activity of *A. candidus* F-81 against
   
   *G. trilaterale* F-75, *A. candidus* F-81 and  
   *A. terreus* var. *aureus* F-79.


F. Inhibitory activity of G. trilaterale F-75 against A. terreus var. aureus F-79 and A. candidus F-81.
A. Activity of *G. trilatetrale* F-75 against
   *B. caraus* var. *mycoides* B-44,
   *S. bikiniensis* A-81 and *S. globisnorum* A-69.

B. Activity of *G. trilatetrale* F-75 against
   *S. globisnorum* A-69, *S. flavovirens* CA-1,
   *S. flaveolus* A-44 and *S. bikiniensis* A-81.

C. Activity of *T. viride* T-10 against
   *S. bikiniensis* A-26, *S. globisnorum* A-69,
   and *S. anulatus* A-71 (Test method 4, pages
   25 & 26).

D. Evans' soil recolonization tube.

E. Antibacterial activity of extracts from supplemented
   soil previously infested with *G. trilatetrale* F-75.

F. Antibacterial activity of soil extracts from
   2. Soils infested with *S. anulatus* A-71.
   3. Control.

1. Control: received no inoculum.
2. Control: received 1 disc inoculum of *P. ultimum* PF-12.
3. Received inoculum of *A. candidus* F-81 and 1 disc inoculum of *P. ultimum* PF-12.
4. Control: received 3 discs inoculum of *P. ultimum* PF-12.
5. Received inoculum of *A. candidus* F-81 and 3 discs inoculum of *P. ultimum* PF-12.

C & D. Effect of *T. viride* T-10 on the occurrence of root-rot of wheat due to *P. ultimum* PF-12.

1. Control: received no inoculum.
2. Control: received 1 disc inoculum of *P. ultimum* PF-12.
3. Received inoculum of the antagonist and 1 disc of the pathogen.
4. Control: received 3 discs inoculum of the pathogen.
5. Received inoculum of both the antagonist - 3 discs of the pathogen.

E & F. Effect of *B. cereus* var. *aureus* B-44 on the occurrence of root-rot of wheat due to *P. ultimum* PF-12.

1. Control: received no inoculum.
2. Control: received 1 disc inoculum of pathogen.
3. Received inoculum of both the antagonist and the pathogen (1 disc).
4. Control: received inoculum of the pathogen (3 discs).
5. Received inoculum of both the antagonist and the pathogen (3 discs).

1. Control: received no inoculum.

2. Control: received inoculum of the pathogen (1 disc).

3. Received inoculum of both the antagonist and the pathogen (1 disc).

4. Control: received inoculum of the pathogen (3 discs).

5. Received inoculum of both the antagonist and the pathogen (3 discs).


1. Control: received no inoculum.

2. Control: received inoculum of the pathogen (1 disc).

3. Received inoculum of both the antagonist and the pathogen (1 disc).

4. Control: received inoculum of the pathogen (3 discs).

5. Received inoculum of both the antagonist and the pathogen (3 discs).

E. Colony counter.
Plate - XX.

A. Non-mutated culture (\textit{S. erythraea} A-15) and the mutant cultures which were isolated after light treatment with ultraviolet radiation.

B. Mutant culture RA-4 which lost capacity to produce aerial mycelium.

C. Antibacterial activity of mutant culture RA-1 against \textit{B. subtilis}.
A. Hydrolysis of starch by non-mutated parent culture (S. erythrasus A-15) and the mutant cultures (RA-1, RA-2 and RA-4).

B. Hydrolysis of casein by Mutant culture RA-4.

C. Non-mutated parent culture C. trilaterale F-75 and the mutant culture (RF-2) which was isolated after irradiation with ultraviolet light.
Plate - XXII.

B. *genus* var. *mycoides* B-44:

A. Colony on nutrient agar (24 hours).

B. Rhizoidal growth (magnified, x2).

C. Endospores: (Spore stain):
   a. Premature spore. x2800.
   b. Mature spores. x2800.

D. Endospores (Gram stain): Spores unstained. x1500.

E. Vegetative cells. x1200.

F. Proteolytic enzyme production (hydrolysis of gelatin).
Plate - XXIII.

A. *S. erythraeus* A-15: Colony on Emerson's medium (magnified, x7). 8 days old.

B. *S. erythraeus* A-15: Vegetative and aerial mycelium. x450.

C. *S. erythraeus* A-15: Sporophores. x1000.

D. Production of proteolytic enzyme (hydrolysis of gelatin) by *S. erythraeus* A-15.

E. *S. anulatus* A-71: Colonies on Emerson's medium (magnified, x10). 8 days old.

F. Production of diastatic enzyme (hydrolysis of starch) by *S. anulatus* A-71.
Plate - XXIV.


B. *S. anulatus* A-71: Sporophores and catenulate spores. x1400.

C. Hydrolysis of gelatin (production of proteolytic enzyme) by *S. anulatus* A-71.

D. Single spore colony of *S. flaveolus* A-44 (magnified, x7). 8 days old.

E. *S. flaveolus* A-44: Sporogenous aerial mycelium and sporophores. x700.

F. Production of diastatic enzyme by *S. flaveolus* A-44.
Plate - XXV.

A. *S. flavovirens* CA-1: Colony on Emerson's medium (magnified, x5). 8 days old.

B. *S. flavovirens* CA-1: Clusters of sporogenous aerial mycelium. x200.

C. *S. bikiniensis* A-81: Colony on Emerson's medium (magnified, x7). 8 days old.

D. *S. bikiniensis* A-81: Sporophores. x600.

E. *S. bikiniensis* A-81: Catenulate spores. x1000.

F. Reduction of litmus by actinomycetes:
   Control (C)
   *S. bikiniensis* A-81 (reduction)
   *Streptomycetes* sp. A-47 (reduction)
   *S. erythraeus* A-15 (no reduction)
   *S. globisporus* A-69 (no reduction)
   *S. virgatus* A-1 (reduction).
Plate - XXVI.

A. *S. bikiniensis* A-26: Colony on Emerson's medium (magnified, x7). 8 days old.

B. *S. bikiniensis* A-26: Sporogenous aerial mycelium and sporophores. x450.

C. *S. bikiniensis* A-26: Catenulate spores. x1250.

D. *S. bikiniensis* A-26: Hydrolysis of starch.

E. *S. bikiniensis* A-26: Hydrolysis of gelatin.

F. *S. bikiniensis* A-31: Colony on Emerson's medium (magnified, x7). 8 days old.
A.  *S. ovaneus* CA-3: Colony on Emerson's medium (magnified, x15). 8 days old.

B.  *S. ovaneus* CA-3: Sporogenous aerial mycelium and sporophores. x200.

C.  *S. ovaneus* CA-3: Hydrolysis of casein.

D.  *S. virratua* A-1: Colony on Emerson's medium (magnified, ?x). 8 days old.

E.  *S. virratua* A-1: Chains of oidiospores. x1000.

F.  *S. vitrata* A-1: Hydrolysis of starch.
Plate - XXVIII.

A. *S. globisporus* GA-2: Colony on Emerson's medium (magnified, x7). 8 days old.

B. *S. globisporus* GA-2: Production of proteolytic enzyme (hydrolysis of gelatin).

C. *S. globisporus* GA-2: Hydrolysis of starch.

D. *S. globisporus* GA-2: Hydrolysis of casein.

E. *S. globisporus* A-69: Colony on Emerson's medium (magnified, x7). 8 days old.

F. *S. globisporus* A-69: Sporogenous aerial mycelium and sporophores. x950.
Plate - XXIX.

A. *Streptomycetes* sp. CA-S: Colony on Emerson's medium (magnified, x7). 8 days old.

B. *Streptomycetes* sp. CA-S: Hydrolysis of gelatin.

C. *Streptomycetes* sp. A-70: Colony on Emerson's medium (magnified, x10). 8 days old.

D. *Streptomycetes* sp. A-10: Colonies on Emerson's medium (magnified, x2). 8 days old.

E. *Streptomycetes* sp. A-30: Colony on Emerson's medium (magnified, x10). 8 days old.

F. *Streptomycetes* sp. A-30: Catenate spores and sporophores. x750.
Plate - XXX.

A. *Streptomyces* sp. A-47: Colony on Emerson's medium (magnified, x5). 8 days old.

B. *Streptomyces* sp. A-47: Sporogenous aerial mycelium. x200.

C. *C. trilaterale* F-75: Colonies on Czapek's agar. 8 days old.

D. Saltant of *C. trilaterale* F-75 which was produced spontaneously.

E. *C. trilaterale* F-75: Peritheciurn. x100.

F. *C. trilaterale* F-75: Ascospores. x1000.
Plate - XXXI.

A. *P. flavescens* F-82: Colonies on Czapek's agar. 8 days old.

B. *A. terreus* var. *aureus* F-79: 8 days old colonies on Czapek's agar.

C. *A. candidus* F-81: 8 days old colonies on Czapek's agar.