Abstract

The study was conducted to work out the distribution of pathogenic mycoflora associated with the seed of ten commercially cultivated variety of wheat and different aspect of most important seed-borne disease of wheat namely Block Point of wheat caused by *Bipolaris sorokiniana* (Sacc.) Shoeam. All the studies were conducted in Directorate of Seed Research, Mau. *Bipolaris sorokiniana* isolates cultured from the seed samples of distant localities viz., HS 1 (Kalyani, W.B.), HS 2 (Hissar Haryana), HS 3 (Kumarganj, U.P.), HS 4 (Ludhiana, Punjab), HS 5 (Mahabaleshwar, M.S.), HS 6 (Dharwad, Karnataka), HS 7 (Sabour, Bihar), HS 8 (Durgapura, Rajasthan), HS 9 (Srinagar, J.&K.), HS 10 (Rewa, M.P.) were subjected for pathogenicity test on variety Sonali ka and Koch’s postulates were proved. Morphology, physiology and pathogenicity study were comprises of important colony characters (colour, size, shape, margin), conidiophore characters (colour, size, number of septa, septa apart) and conidial characters (colour, size, number of septa, shape) of the test isolates. Sporulation was studied on Potato Dextrose Broth Medium. Conidiophore & conidial characters and its germination pattern was studied by hanging drop method using 12 days old cultures. Variability amongst the *Bipolaris sorokiniana* isolates cultured from the seed samples of distant localities were worked out on set of the differential lines comprising of fifteen wheat genotypes viz. PATO(R) TZ PPSN 64 NAR, PUSA T 3336, HDR 180, VL 738, ISWYT, PBW 343, Bob white, RL 10-12, Raj 6516, T 3105, K 9408, C 306, UP 2338, WH 542 and Agra Local. To work out the distribution of seed borne mycoflora, seeds of ten commercially cultivated wheat cultivars viz., PBW 343, PBW 550, DBW 17, UP 262, UP 2338, WH 711, HD 2733, Raj 3765, Raj 4037 and Raj 6516 were collected in sterilized polythene bags, stored and subjected
for different detection techniques for seed-borne pathogenic mycoflora. The techniques were Dry Seed Examination Methods, Standard Blotter method, Standard Agar Plate method, Standard Ragdoll method. Two sets of seed samples (untreated and surface sterilized) of different wheat seed samples were examined for the associated seed borne mycoflora. In The Dry Seed Examination Methods, dry seeds were subjected to the visual inspection by naked eye, under stereoscopic binocular microscope added with cool-light condition and by modified purity work board. In Standard Blotter Method, untreated seeds and seeds after treatment with 0.1% HgCl₂ for 3 minutes were placed on three layers of moistened blotter, 25 seeds per petridish. In Standard Agar Plate Method untreated seeds and seeds after surface disinfection with 0.1% HgCl₂ for 3 minutes were placed on Potato Dextrose Agar media (PDA) having pH 5.5 where as in Standard Ragdoll Method twenty-five seeds of wheat, each of untreated and surface sterilized with 0.1% HgCl₂ for 3 minutes were directly placed on moist whatman filter paper which was rolled in tubular form and kept in that form with the help of a rubber ring. For maintaining cultures of fungi Potato Dextrose Agar, CzapakDox Agar and SNA media were used. Studies on efficacy, viability and development of formulations of bio-agents and its effect on disease comprises the isolation and maintenance of biocontrol agent, antagonistic study, effect of coating seeds with antagonistic fungi, effect of antagonistic culture filtrate on pathogen, viability of different formulation and effect of suitable formulation on black point incidence.

Ten monoconidial isolates of Bipolaris sorokiniana from wheat seed of distant localities were tested for their variability. In pathogenic capabilities, the isolates differed strikingly irrespective of the host. The isolate from Sabour, Bihar was found to be most virulent followed by Kumarganj, UP; Hissar, Haryana and Ludhiana,
Punjab. Colony characters of Kumarganj and Sabour isolates showed fastest growth, wavy with raised central zone, grayish black colour and irregular margin whereas Kalyani and Durgapura were slow growing isolates. Sporulation varied from fair to excellent with different isolates, but no definite relation was established. In conidiophore and conidial characters, the average length of conidiophore of Kumarganj isolate was maximum (143.32µ) as against the Dharwad, Karnataka isolate which had the minimum (132.52µ) average length. The average length of conidia of Kumarganj isolate was maximum (70.99µ) against the minimum (55.33µ) in Kalyani isolate. Maximum average width of conidia and conidiophore was associated with Sabour and Srinagar isolates, respectively. Regarding conidial germination percentage and its pattern, Sabour isolate resulted in the maximum (99.00 %) germination with bipolar germination pattern followed by Kumarganj, Rewa, Ludhiana, Srinagar, Dharwad, Hissar, Mahabaleshwar, Kalyani and Durgapura isolates.

The commercially cultivated wheat seed samples of all the varieties were analyzed on standard purity work board under dry conditions. Healthy and diseased seeds were sorted out by visual examination. The maximum fruiting body seed was recorded 19.66 % with the variety PBW 343 followed by 03.90% (WH 711) and 2.40 % (Raj 3765) whereas minimum fruiting body seed was recorded 00.60 % with the three variety PBW 550, UP 2338 and Raj 6516 followed by 00.80 % (Raj 4037). Minimum discoloured seed was recorded 00.60 % with the two variety HD 2733 and UP 262 followed by 00.90 % (PBW 550) and maximum was observed 07.30 % with the variety WH 711 followed by 3.10 % with the variety UP 262 and 02.30 % with the variety Raj 3765. Overall under the dry seed examination (a non-destructive) method of detection, variety Raj 4037 was rated as resistant to seed-born mycoflora.
with 93.20% healthy seed, 00.70% deformed seed, 03.30% wrinkled seed, 02.00% discoloured seed and 00.80% fruiting body seed. Variety WH 711 was rated as susceptible in respect to physical seed abnormalities with 61.90% healthy seed, 06.20% deformed seed, 20.70% wrinkled seed, 07.30% discoloured seed and 03.90% fruiting body seed.

Standard Blotter Paper Method recorded, maximum fifteen (15) pathogenic mycoflora were recorded under untreated condition in variety HD 2733 seeds with 88.00% germination and 17.00% diseases seed followed by 12 pathogenic mycoflora in variety PBW 343 with 93.60% germination and 12.60% diseased seeds. *Bipolaris sorokiniana*, *Alternaria alternata*, *Alternaria triticina*, *Curvularia lunata*, *Curvularia pallescens*, *Fusarium oxysporum*, *Macrophomina phaseolina*, *Trichoderma hamatum*, *Cladosporium cladosporioides*, *Epicoccum purpurascens*, *Nigrospora oryzae*, *Aspergillus flavus*, *Aspergillus niger*, *Penicillium spp.* and *Rhizopus spp.* were the mycoflora found associated with the untreated seeds of variety HD 2733. Whereas under treated seed condition, HD 2733 yielded maximum 11 numbers of pathogenic mycoflora with 90.60% germination and 12.00% diseased seed followed by PBW 343 with 96.30% germination and 11.60% diseased seed. Maximum 94.60% germination with the variety UP 262 and minimum 88.00% germination with HD 2733 was recorded under untreated condition whereas maximum 96.60% germination of variety PBW 550 and minimum 90.06% germination of variety HD 2733 under treated conditions of the seeds. Overall, variety HD 2733 yielded maximum 15 numbers of pathogenic mycoflora (88.00% germination and 17.00% diseased seed) under untreated condition and 11 numbers of pathogenic mycoflora (90.60% germination and 12.00% diseased seed) under treated condition and rated as susceptible variety. Whereas Raj 4037 yielded minimum 8 numbers of pathogenic
mycoflora (92.60 % germination and 02.00 % diseased seed) under untreated condition and 6 numbers of pathogenic mycoflora (94.60 % germination and 01.60 % diseased seed) under treated condition and rated as resistant variety. All the varieties reduced their seed-borne pathogenic mycoflora load after surface sterilization which indicates the loose bonding of mycoflora at seed surface of wheat varieties. *Fusarium oxysporum* was found associated in all the varieties in both the condition of seed, either in untreated condition or in treated condition except variety UP 262. *Bipolaris tetramera and Chaetomium globosum* were not isolated in this method as compared to Standard Agar Plate Method.

Association of pathogenic mycoflora with commercially cultivated wheat seeds by following the Standard Agar Plate Method were recorded, maximum seventeen pathogenic mycoflora under untreated condition in variety HD 2733 seeds with 83 % germination and 20.33 % diseases seed followed by 14 pathogenic mycoflora in variety PBW 343 with 94.33% germination and 16 % diseased seeds. *Bipolaris sorokiniana, Bipolaris tetramera, Alternaria alternata, Alternaria triticina, Curvularia lunata, Curvularia pallescens, Fusarium oxysporum, Macrophomina phaseolina, Chaetomium globosum, Trichoderma hamatum, Cladosporium cladosporioides, Epicoccum purpurascens, Nigrospora oryzae, Aspergillus flavus, Aspergillus niger, Penicillium spp.* and *Rhizopus spp.* were the mycoflora found associated with the untreated seeds of variety HD 2733.

Maximum 94.33 % germination with the variety PBW 343 and minimum 83.00 % germination with HD 2733 was recorded under untreated condition whereas maximum 98.00 % germination of variety PBW 343 and minimum 89.00 % germination of variety HD 2733 and UP 2338 were recorded under treated conditions of the seeds. Under untreated condition, maximum 20.33 % diseased seed was
recorded with the variety HD 2733 as compared to the minimum 04.33 % disease seed of Raj 4037. These were at par with the variety PBW 343 (16.00%) and variety DBW 17 (06.33%), respectively. Overall, variety HD 2733 yielded maximum 17 numbers of pathogenic mycoflora (83.00 % germination and 20.33 % diseased seed) under untreated condition and 12 numbers of pathogenic mycoflora (89.00 % germination and 15.33 % diseased seed) under treated condition and rated as susceptible variety. Whereas Raj 4037 yielded minimum 9 numbers of pathogenic mycoflora (91.33 % germination and 04.33 % diseased seed) under untreated condition and 6 numbers of pathogenic mycoflora (92.00 % germination and 2.66 % diseased seed) under treated condition and rated as resistant variety. All the varieties reduced their seed-borne pathogenic mycoflora load after surface sterilization which again indicates the loose bonding of mycoflora at seed surface of wheat varieties.

Among the seed samples tested by employing Standard Ragdoll Method, maximum thirteen (13) pathogenic mycoflora were recorded under untreated condition in variety HD 2733 seeds with 90.00 % germination, 16.25 % diseases seed, 06.600 cm shoot length, 15.00 cm root length, 147.30 mg seedling dry weight, 19.40 Vigour Index I and 132.04 Vigor Index II followed by 10 pathogenic mycoflora in variety PBW 343 with 94.60 % germination, 11.50 % diseased seeds, 07.66 cm shoot length, 15.60 cm root length, 120.66 mg seedling dry weight, 19.50 Vigour Index I and 114.25 Vigor Index II. Bipolaris sorokiniana, Alternaria alternata, Alternaria triticina, Curvularia lunata, Curvularia pallescens, Fusarium oxysporum, Trichoderma hamatum, Cladosporium cladosporioides, Epicoccum purpurascens, Aspergillus flavus, Aspergillus niger, Penicillium spp. and Rhizopus spp. were the mycoflora found associated with the untreated seeds of variety HD 2733. Maximum 94.33 % germination with the variety PBW 343 and minimum 83.00 % germination
with HD 2733 was recorded under untreated condition whereas maximum 98.00 %
germination of variety PBW 343 and minimum 89.00 % germination of variety HD
2733 and UP 2338 were recorded under treated conditions of the seeds. Under
untreated condition, maximum 20.33 % diseased seed was recorded with the variety
HD 2733 as compared to the minimum 04.33 % disease seed of Raj 4037. Under
untreated condition, maximum 18.60 cm shoot length was recorded with the variety
DBW 17 as compared to the minimum 06.60 cm shoot length of HD 2733 and UP
2338. In respect to root length under untreated condition maximum 20.30 cm root
length was recorded with variety PBW 550 followed by 17 cm (Raj 6516) with the
minimum 05.60 cm root length with the variety UP 262 followed by 11.60 in variety
DBW 17. Maximum 172.30 mg seedling dry weight was recorded with variety PBW
550 followed by 165.00 mg (DBW 17) and minimum 120.00 mg seedling dry weight
with the variety Raj 6516 followed by 126.33 mg in variety UP 2338 under untreated
condition. Overall, variety HD 2733 seeds with 90.00 % germination, 16.25 %
diseases seed, 06.60 cm shoot length, 15.00 cm root length, 147.30 mg seedling dry
weight, 19.40 Vigour Index I and 132.04 Vigor Index II under untreated condition
and 10 numbers of pathogenic mycoflora with 91.60 % germination, 15.00 % diseases
seed, 09.30 cm shoot length, 17.30 cm root length, 150.30 mg seedling dry weight,
24.47 Vigour Index I and 137.78 Vigor Index II under treated condition and rated as
susceptible variety .Whereas Raj 4037 under untreated seed with 94.00 %
ermination, 02.50 % diseases seed, 08.30 cm shoot length, 15.30 cm root length,
146.30 mg seedling dry weight, 21.34 Vigour Index I and 137.51 Vigor Index II and
under treated condition and 6 numbers of pathogenic mycoflora with 97.60 %
germination, 01.50 % diseases seed, 10.30 cm shoot length, 18.30 cm root length,
150.00 mg seedling dry weight, 27.91 Vigour Index I and 146.49 Vigor Index II rated
as resistant variety. Again all the varieties reduced their seed-borne pathogenic mycoflora load after surface sterilization which indicates the loose bonding of mycoflora at seed surface of wheat varieties. Standard Ragdoll Method was not found suitable to isolates the Bipolaris tetramera, Macrophomina phaseolina, Chaetomium globosum and Nigrospora oryzae whereas these pathogenic mycoflora was isolated in other methods. Variety WH 711 seed was only found associated with Nigrospora oryzae under untreated condition. Whereas variety UP 262 dose not yielded Trichoderma hamatum neither in untreated condition nor in treated condition.

The sum total of 17 fungal spp. viz., Bipolaris sorokiniana, Bipolaris tetramera, Alternaria alternata, Alternaria triticina, Curvularia lunata, Curvularia pallescens, Fusarium oxysporum, Macrophomina phaseolina, Chaetomium globosum, Trichoderma hamatum, Cladosporium cladosporioides, Epicoccum purpurascens, Nigrospora oryzae, Aspergillus flavus, Aspergillus niger, Penicillium spp. and Rhizopus spp. were found associated with the samples of wheat seeds by employing all the techniques of mycoflora detection. As a whole Standard Agar Plate Method was found best, detected maximum number (17) of seed-borne mycoflora namely Bipolaris sorokiniana, Bipolaris tetramera, Alternaria alternata, Alternaria triticina, Curvularia lunata, Curvularia pallescens, Fusarium oxysporum, Macrophomina phaseolina, Chaetomium globosum, Trichoderma hamatum, Cladosporium cladosporioides, Epicoccum purpurascens, Nigrospora oryzae, Aspergillus flavus, Aspergillus niger, Penicillium spp. and Rhizopus spp. followed by the Standard Blotter Paper Method and Standard Ragdoll Method. Standard Blotter Paper Method yielded Bipolaris sorokiniana, Alternaria alternata, Alternaria triticina, Curvularia lunata, Curvularia pallescens, Fusarium oxysporum, Macrophomina phaseolina, Trichoderma hamatum, Cladosporium cladosporioides, Epicoccum purpurascens,
Nigrospora oryzae, Aspergillus flavus, Aspergillus niger, Penicillium spp. and Rhizopus spp. whereas Standard Ragdoll Method yielded Bipolaris sorokiniana, Alternaria alternata, Alternaria triticina, Curvularia lunata, Curvularia pallescens, Fusarium oxysporum, Trichoderma hamatum, Cladosporium cladosporioides, Epicoccum purpurascens, Aspergillus flavus, Aspergillus niger, Penicillium spp. and Rhizopus spp. Five seed-borne mycoflora viz., Bipolaris sorokiniana, Alternaria alternata, Macrophomina phaseolina, Epicoccum purpurascens and Nigrospora oryzae were not detected by employing the Standard Ragdoll Method. Standard Agar Plate Method was the best suited method for the detection of Bipolaris sorokiniana, Alternaria alternata, Alternaria triticina, Curvularia lunata, Curvularia pallescens and Nigrospora oryzae. In respect to different pathogen, Standard Agar Plate Method was found to be the most suited detection method for the detection of seed-borne pathogens in wheat. Apart from the best suited method, analysis was done for other methods also and result revealed that Standard Agar Plate Method was best suited for the detection of Bipolaris sorokiniana. Standard Blotter Paper Method was best suited Alternaria alternata and Curvularia lunata. Standard Ragdoll Method was best suited for the detection of Cladosporium cladosporioides.

Antagonistic study of Bipolaris sorokiniana was conducted against ten different native isolate of Trichoderma harzianum by following the dual culture technique. Maximum 88.87 % inhibition was recorded with T₃ followed by T₈ (86.08 %) as compare to minimum of 83.83 % with rest of the treatments at the age of 24 hours. After 48 hours maximum inhibition was observed 52.76 % with T₃ followed by 33.33 % in T₈ as compare to minimum 10.41 % in T₁ followed by T₉ whereas Bavistin recorded maximum 81.20 % inhibition as compare to control 16 % inhibition. After 72 hours same trend was observed that T₃ recorded maximum inhibition of 40.60 %
followed by T₈ (38.53 %) as compared to minimum of 15.60 % in T₁ followed by T₁₀ (18.60 %). Rest of the isolates recorded in between. At the age of 96 hour again T₃ was recorded maximum 56.90 % inhibition. Overall T₃ isolate of *Trichoderma harzianum* was recorded as most virulent isolate to inhibit the growth of black point pathogen recorded 88.87 %, 52.76 %, 40.60% and 56.90% inhibition at the age of 24 hours (h), 48h, 72h, 96h, respectively and at par with the T₈ isolates (86.08%, 33.33%, 38.53% and 48.56%). These isolates were statistically superior over the other for inhibition of pathogen. Isolate, T₁ and T₁₀ of *T. harzianum* was rated as non-virulent isolates recorded 83.30 %, 10.41%, 15.60%, 16.63% with T₁ and 83.30%, 12.50%, 24% and 35.23% with T₁₀ at the age of 24h, 48 h, 72h and 96h, respectively. Rest of the isolates of *T.harzianum* was recorded in between in respect to the inhibition of black point pathogen. All the isolates of *T.harzianum* recorded statistically significant inhibition over the Bavistin treatment which revealed that all the *T. harzianum* isolates poses the property of inhibiting of black point pathogen (*B.sorokiniana*).

Effect of *Trichoderma harzianum* and seed vigour of two most virulent isolates of *T. harzianum* namely T₃ isolate and T₈ isolate on three most black point disease susceptible and maximum commercially cultivated wheat varieties viz., HD 2733, PBW 343, and UP 2338 recorded maximum 97.66 % germination with T₃ isolates of *T. harzianum* in variety PBW 343 as compare to 63.00 % germination in infected seed without any treatments whereas healthy seed recorded 92.66 % germination without any treatments. Maximum 95.66 % germination was recorded with variety HD 2733 treated with T₃ isolate of biocontrol agent over the control (43.66 %). In respect to seed rot, minimum 01.66% seed rot was recorded with T₃ isolate of *T. harzianum* as compare to the 26.66 % seed rot in control with the seed of PBW 343 variety. HD 2733 recorded minimum of 03.33 % seed rot with the same isolates whereas variety
UP 2338 recorded minimum of 03.00 % seed rot over the control of 35.66 % and 32.00 % seed rots, respectively. Minimum 08.33 %, 05.33 % and 10.33 % diseased seedling was observed in the variety HD 2733, PBW 343 and UP 2338, respectively after the treatment of T₃ isolate of *T. harzianum*.

The length of seedling was recorded maximum of 30.33 cm with the variety HD 2733, 30.66 cm with the variety PBW 343 and 29.00 cm with the variety UP 2338 and superior over the infected seed without any treatment of 17.33 cm, 18.33 cm and 16.00 cm, respectively. Significant increase of seed vigour was recorded with seeds of all the varieties treated with T₃ isolates of *T. harzianum* recorded 32.44 in HD 2733, 29.95 in PBW 343 and 27.52 in UP 2338 over the control of 07.54, 11.55 and 07.97, respectively.*T. harzianum* isolates T₃ (virulent)and T₈ (virulent) resulted significantly effective through seed coating against *B. sorokiniana* irrespective of any of the variety. Seed coating of HD2733 seed against *B. sorokiniana* by isolates T₃ recorded 95.66% seed germination, 03.33 % seed rot, 08.33 % diseased seedlings 30.33 cm seedling length and 29.02 seed vigour.Whereas PBW 343 recorded 97.66 % germination, 01.66 % seed rot, 05.33 % diseased seedling 30.66 cm seedling length and 29.95 seed vigour and variety UP 2338 recorded 96.00 % germination, 03.00 % seed rot, 10.33 % diseased seedling, 29.00 cm seedlings length and 27.52 seed vigour.

Effect of antagonistic culture filtrate on % seed germination and % seed colonization by *Bipolaris sorokiniana* were worked out. Seed colonization by the black point fungus was significantly decreased as the filtrate concentration increased irrespective of any treatments. Filtrate from culture of *T. harzianum* protected completely the infected wheat seeds from colonization by the pathogen, indicating that an antibiotic or toxic substance may also be produced that effectively hamper development of black point pathogen fungus and protect the seeds from infection. Out
of five concentration *viz.*, 2%, 6%, 10%, 14% and 18% of culture filtrate, T₃ isolate of *T. harzianum* was found most effective as compare to the T₁₄ isolate of *T. harzianum*. T₃ isolate of *T. harzianum* recorded 89.60% germination and 39.00% colonization at 2% concentration, 87.66% germination and 38.00% colonization at 6% concentration, 90.66% germination and 35.00% colonization at 10% concentration, 91.66% germination and 28.00% colonization at 14% concentration, 97.00% germination and 25.66% colonization at 18% concentration in variety HD 2733. Rest of the varieties also showed similar trained of results and statistically significant over the control.

Viability of different formulation *viz.*, Talc power (St), Talc power (Us), Peat power, Multani soil, Lignite, Vermiculite, Wheat brain and Rice brain had been studied recorded decreased trained of *T. harzianum* viable spores with the increase of storage period. Immediate after formulation, Rice Brain formulation was recorded the highest CFU $77.88 \times 10^3$ g⁻¹ followed by $46.15 \times 10^3$ g⁻¹ of Multani Soil. Whereas, At the age of 60 days after formulation, maximum CFU of $76.56 \times 10^3$ g⁻¹ was recorded in Talc powder (St.). By attaining the 90 days after formulation, Talc Powder (St.) recorded highest $58.90 \times 10^3$ g⁻¹ CFU followed by $48.73 \times 10^3$ g⁻¹ CFU of Talc Powder (Us.) whereas one hundred twenty days after formulation, maximum $65.84 \times 10^3$ g⁻¹ CFU was observed in Talc Powder (St.) formulation. Talc powder (St.) was found most suitable in respect to *T. harzianum* viability for long storage followed by Talc powder (St.) formulation over long period of time followed by Talc powder (Us.) formulation. At the early stage of formulation, both these formulation was recorded low CFU as compare to other formulation. Talc Powder (St.) was recorded $21.11 \times 10^3$ g⁻¹ at IAP, $14.77 \times 10^3$ g⁻¹ at 30 DAP, $76.56 \times 10^3$ g⁻¹ at 60 DAP, $58.98 \times 10^3$ g⁻¹ at 90 DAP and $65.84 \times 10^3$ g⁻¹ CFU at 120 DAP whereas Talc powder (Us.) formulation recorded $17.78 \times 10^3$ g⁻¹ at IAP, $13.25 \times 10^3$ g⁻¹ at 30 DAP,
68.20 g⁻¹ at 60 DAP, 48.73 g⁻¹ at 90 DAP and 56.37 g⁻¹ CFU at 120 days after preparation (DAP) and these two formulation were rated as best formulation out of eight type of *T. harzianum* formulation.

Study on effect of best five formulations (Out of eight different formulation) of *T. harzianum* on seed germination, shoot and spike length, yield, test weight and black point incidence on variety HD 2733 under field conditions recorded maximum germination of 78.00% after seed coating of Tale powder (St.) followed by 69.00% with Vermiculite formulation. Maximum 83.10 cm and 11.63 cm of shoot and spike length were recorded with Talc Powder (St.) formulation followed by 80.96 cm and 09.53 cm with Vermiculite formulation, respectively.

Minimum black point incidence of 24.00% was observed with coating of Talc Powder (St.) formulation followed by 34.33% black point incidence of Vermiculite formulation coating seed over the control of 78.33%. Talc Powder (St.) coated seed recorded lower incidence of black point as compare to four other formulations. Significant increase of yield was recorded through seed coating of *T. harzianum* formulation over the control of 23.10 qtls/ha. Best 42.18 qtls/ha yield was recorded in Talc Powder (St.) coated seeds. Talc Powder (St.) formulation was rated best form other formulations, recorded significantly superior of 78.00% germination, 83.10% shoot length, 11.63 cm spike length, 24.60% back point incidence, 42.18 qtls/ha yield and 44.50 g test weight followed by Vermiculite formulation recorded, 69.00% germination, 41.06 cm shoot length, 09.53 cm spike length, 34.33% black point incidence, 39.60 qtls/ha yield and 39.66 g test weight.