Annual Progress Report: 2017-18

3. Plant Pathology

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Executive summary

Survey and Surveillance: Survey and surveillance of farmers field was conducted in six centers *viz.,* Athiyandal, Mandya, Jagdalpur, Ranchi, Ranichauri and Vizianagaram for finger millet diseases and at Nandyal for foxtail millet, at Ranichauri for Barnyard millet, at Rewa for little millet and kodo millet diseases. Finger blast was recorded as high as up to 36.67 per cent at Ranchi, 32 per cent at Ranichauri and 31 per cent at Mandya in farmers field, mostly on local varieties. Neck blast was recorded up to 18.33 per cent at Ranchi, 22 per cent at Ranichauri. In foxtail millet leaf blast was recorded as high as five grade in Suryanandi variety in Nandyal. Leaf shredding phase of downy mildew also observed in most of the farmers fields. In little millet grain smut (0-28 %) and banded blight (0-21.5 %) was recorded high at Rewa. Grain smut (0-42 %), head smut (0-4 %) and sheath blight (0-20.6 %) was recorded in barnyard millet at Ranichauri area. In Kodo millet, head smut (0-7.0%), banded blight (0-26 %) and non-parasitic disease/Phanerogamic parasite *Striga* spp. infection was also noticed up to 12.5 per cent in Sindhi district, Rewa, M.P. state.

Finger millet Initial Varietal Trial (FIVT): Twenty five varieties of finger millet along with checks GPU-45, GPU GPU-67, VL-352 and PR-202 were evaluated for their resistance to major diseases of leaf, neck and finger blast, banded blight, foot rot, cercospora leaf spot (G), smut (%) and grain mould (G) in hotspot locations. Blast incidence ranges from low to high in different locations. Range of diseases in different varieties were : leaf blast 2.89 to 5.39, neck blast 19.99 to 69.04 per cent , finger blast 18.2 to 54.36 per cent . Resistant lines for banded blight were tested in three hotspot locations *viz.,* Jagdalpur, Ranchi and Rewa. Among three locations at Rewa the incidence of banded blight was highest (45.1%), however, at Ranchi (28.33 %) and Jagadalpur (13 %) the incidence was moderate.

Brownspot: Among four hotspot areas *viz*., Athiyandal, Berhampur, Jagdalpur and Ranichauri high disease pressure was recorded in Ranichauri (6.33 G) followed by Behrampur (5.00 G).

Footrot: Among three hotspot areas *viz*., Berhampur, Mandya, Ranchi high disease pressure was recorded in Berhampur range from 7.4 to 41.6 per cent followed by Ranchi 3.89 to 10.56 per cent.

Cercospora leaf spot (CLS): The only hotspot for CLS Ranichauri centre has reported high incidence of CLS (9 G) with a mean value of 7.21.

Grainmould: The grain mould resistant varietal screening was conducted at Athiyandal centre and the disease grade varied from 1.58 to 23.48 per cent with mean value of 9.94 per cent.

Finger millet Advanced Varietal Trial (AVT)-South Zone: Among four finger millet entries along with 4 checks GPU-45, VL-352, GPU-67, PR-202 tested for their resistance to leaf blast, neck blast, finger blast, foot rot, banded blight, brown spot and grain mould (%), highest leaf blast incidence was recorded in Mandya centre with mean value of 6.13 (G) as compared to 2.71 (G) at Athiyandal. Highest finger blast incidence was recorded from Vizianagaram (61.53 %) followed by Berhampur (31.92 %). Entry FMV 1104 found resistant to neck blast. Check variety GPU-45 found best against foot rot as compared to other entries.

Banded blight: Entry FMV 1102 was found resistant against banded blight at Jagadalpur centre.

Brownspot: Brown spot was observed relatively high at Berhampur with a mean grade of 4.58 per cent. However, FMV 1104 found best against brown spot disease.

Grainmould: Grain mould was located at Athiyandal centre with mean average of 6.14 per cent . However, FMV 1101 showed resistance to grain smut (1.51 %) as compared to the entries.

Finger millet Advanced Varietal Trial (AVT)-North zone: Among eleven finger millet entries along with 4 checks GPU-45, VL-352, GPU-67, PR-202 tested for their resistance to leaf blast, neck blast, finger blast, banded blight and brown spot, highest leaf, neck and finger blast incidence was recorded in Rewa centre with mean value of 4.71(G), 8.67 and 4.71 per cent respectively as compared to Ranchi and Ranichauri in North zone. Highest banded blight incidence was recorded in Rewa centre with mean value of 33.07 per cent as compared to Ranchi which accounted 6.16 per cent. Brown spot incidence was observed only at Ranichauri by recording 2.33- 4.67 (G) on 1-9 scale with mean value of 2.73. All tested entries showed moderately resistant reaction to Brown spot at Ranichauri.

Foxtail millet Initial and Advanced Varietal Trial (FIAVT): Thirteen entries along with 2 checks were tested for their resistance to blast across six locations *viz*., Athiyandal, Mandya, Nandyal, Vizianagaram, Ranichauri, Ranchi and Rewa. The disease mean was highest in Rewa (5.28) and Mandya (5.28) as compared to other location.

Rust screening was also done at Mandya and Athiyandal with a mean value of 7.49 and 2.69 respectively. Cercospora leaf spot and downy mildew were also reported in Nandyal centre with a mean value of 7.4 and 9.72 respectively.

Little millet Initial and Advanced Varietal Trial (LIAVT): Fifteen entries along with their checks were tested for brown spot at Athiyandal, Jagdalpur, CLS at Ranchi, smut at Rewa, banded blight at Vizianagaram, Berhampur, Jagdalpur, Ranchi and Rewa. Maximum (75.63%) Banded blight incidence was recorded at vizianagarum in south zone followed by Rewa and Ranchi which accounted 40.01 and 31.20 per cent respectively. The brown spot incidence was less at Jagdalpur and Athiyandal with mean value of 2.94 and 1.54. Cercospora leaf spot incidence was relatively high at Ranchi with mean value of 8.9.

Proso millet Initial and Advanced Varietal Trial (PIAVT): Four entries along with three checks were tested for banded blight at Vizianagaram and leaf blight at Ranichauri centre. The banded blight disease incidence was very high at Vizianagaram with mean value of 73.14. Leaf blight was relatively less at Ranichauri with mean value of 3.48.

Kodo millet Initial and Advanced Varietal Trial (KIAVT): Seven entries along with 3 checks were tested for blast at Rewa, banded blight at Jagadalpur, head smut at Mandya, Jagadalpur and Rewa, *Striga* spp. at Rewa, blight at Athiyandal, Mandya and Vizianagaram and grain smut at Ranchi and Rewa. None of the entries were found resistant to banded blight.

Barnyard millet and Advanced Varietal Trial (BIAVT): Six entries along with 2 checks were tested for blast at Athiyandal, Mandya and Vizianagarm and for grain smut at Ranchi and Rewa. The blast incidence was very high at Vizianagaram with mean value of 63.50 followed by Mandya (54.36). Highest grain smut incidence was recorded at Ranchi with mean value of 24.93 per cent followed by Rewa (17.77 %)

Eco-friendly management of banded blight in six small millets: Continuously for two years, ecofriendly management of banded blight trials were conducted over five locations and in all six small millets, soil application of value added *Pseudomonas fluorescence* + *Trichoderma viride* + *Bacillus subtilis* not only minimized the disease but also enhanced grain and fodder yield.

Detailed report

Coordinated trails on six millets *viz.,* finger millet, foxtail millet, kodo millet, little millet, barnyard millet and proso millet were conducted at 11 AICRP centres located in eight different states and a lone voluntary centre at VPKAS, Almora (Uttatakhand). During the *kharif* 2017, all centres could implement the programme in toto

1. Survey and surveillance for the important of diseases of finger millet and small millets

FM (PP) 300: Survey and surveillance for the incidence of diseases of finger millet- Survey and surveillance of diseases is essential to monitor occurrence of different diseases vis-à-vis the extent to which it occurs. It also provides information on new disease/s noticed alongside the location and varieties affected for planning the breeding and management strategies.

Jagdalpur: Moderate to low incidence of blast disease was observed in the finger millet varieties of Jagdalpur area. (Table 1.3)

Vizianagaram: On surveying the areas of Vizianagaram district it was revealed that moderate incidence of leaf, neck and finger blast occurred in the Sri Chaitanya variety of finger millet. (Table 1.4)

Ranichauri: In local as well as imported varieties low leaf blast was noticed and in some areas variety PRM-2 was found to be resistant to LB. However, Neck and finger blast occurrence was moderate (Table 1.5)

Ranchi: Variety BBM- 10 was resistant as compared to local as well as other improved varieties. (Table 1.8)

SM (PP) 300: Survey for the incidence of diseases of other millets:

Nandyal- Suryanandi, KDR and Srilaxmi of foxtail millet varieties were resistant to rust; Leaf shredding was seen to the tune of 1% in Suryanandi variety. (Table 1.7)

Ranichauri- Survey was conducted in barnyard millet and resistance was observed in all the locations for head smut and in most of the locations local as well as improved varieties showed resistance to banded blight disease. (Table 1.8)

Rewa- The little millet variety JK 4 was found to be resistant to grain mould and variety JK 4, JK 8 and JK 36 were also found to be resistant to banded blight. (Table 1.9)

Kodo millet: Head smut, banded blight and *Striga spp.* were recorded low to moderate level in farmers field at Rewa centre. Banded blight incidence range from 0-26 per cent and *Striga spp.* also recorded up to 11 per cent (Table 1.10)

2. Evaluation of Coordinated breeding materials for diseases

FM (PP) 301.1: Evaluation of IVT: A set of 29 entries were evaluated for resistance to major diseases at eight centres *viz.,* Athiandal, Berhampur, Mandya, Jagdalpur, Vizianagaram, Ranichauri, Ranchi and Rewa. Amongst all FMV 1114 was resistant to leaf blast but not to finger and neck blast, whereas FMV 1112 and FMV 1113 were moderately resistant to neck and leaf blast. Moderate resistance was observed in FMV 1121, FMV 1126, FMV 1129, FMV 1130 and FMV 1134 for banded blight. However, not much of foot rot disease was observed. No resistance was observed for Cercospora leaf spot and brown spot. Varieties FMV 1114, FMV 1122, FMV 1128, FMV 1130, FMV 1132, FMV 1135 and VL 352 (check) were having resistance to grain mould. (Table 2.1)

FM (PP) 301.2: Evaluation of AVT: Both early and medium maturity groups were screened for resistance at five centres *viz.,* Athiandal, Berhampur, Mandya, Jagdalpur and Vizianagaram. Resistance was observed in FMV 1103, FMV 1104 and PR 202 (check) for neck blast. Late maturity group was screened for resistance at three

centres Ranichauri, Ranchi and Rewa where leaf blast (4.71 %), finger blast (4.71 %), neck blast (7.43 %) and banded blight (33.07 %) was recorded highest in Rewa. (Table 3.1, 3.2). In South zone centres highest (8) leaf blast (G) was recorded in Mndya followed by berhampur (4.79). Highest (64.25 %) neck blast incidence was recorded in Vizianagaram followed by Berhmapur (37.43 %). Foot rot and brown spot incidence was highest at Berhmapur and Grain mould incidence was noticed only at Athiyandal both on tested entries and check varieties viz., VL 352, GPU 67, and PR 202. (Table 3.3, 3.4, 3.5, 3.6)

SM (PP) 301.1: Evaluation of Little millet Initial and Advanced Varietal Trial (LIAVT):

By mean performance of five locations *viz.,* Berhampur, Jagdalpur, Ranchi, Rewa and Vizianagaram no entry was resistant to banded blight. (Table 4.2)

SM (PP) 301.2: Evaluation of Kodo millet Initial and Advanced Varietal Trial (KIAVT):

The entry check was found to be resistant for smut across the three centres *viz.,* Mandya, Jagdalpur and Rewa but no entry was promising to banded blight and leaf blight an emerging problem of the crop. However, many entries were resistant to moderately resistant for blast and grain smut. (Table 4.3)

SM (PP) 301.3: Evaluation of Foxtail millet Initial and Advanced Varietal Trial (FIAVT):

All the entries were moderately resistant to blast, whereas, entry FXV 607 was resistant and entry FXV 605 was moderately resistant to rust. FXV 613 and SiA 326 (check) were found to be resistant to brown spot. (Table 4.5)

SM (PP) 301.4: Evaluation of Proso millet Initial and Advanced Varietal Trial (PIAVT):

Seven entries of Proso millet were evaluated for resistance against major diseases at Vizianagaram and Ranichauri. No entry showed resistance for banded blight while PMV 442 and PMV 444 showed resistance to leaf blight. (Table 4.1)

SM (PP) 301.5: Evaluation of Barnyard millet Initial and Advanced Varietal Trial (BIAVT):

Among eight entries tested in six locations banded blight disease was recorded at very high in Vizianagaram with mean value of 63.5 per cent followed by Mandya (54.36 %) Grain smut was recorded high at Ranchi with mean value of 24.93 % as againt 17.77 at Rewa. (Table 4.4)

3. Evaluation of Donor screening nursery (DSN)

SM (PP) 302: Donor screening nursery (DSN): Identification of resistant source to major diseases of a crop is essential to generate information on lines showing multiple disease resistance. In this background selected cultures of kodo millet, little millet, foxtail millet, barnyard millet and proso millet were screened at different locations for reaction to major diseases to locate sources with multiple disease resistance for use as donors.

SM (PP) 302.1: Evaluation of DSN finger millet: DSN finger millet was evaluated at six locations *viz.,* Rewa, Ranchi, Ranichauri, Athiyandal, Jagadalpur, Vizianagaram and the neck blast incidence range from 6.57%- 44.94 % mean values. Finger blast was recorded highest at Vizianagaram (36.7 %) followed by Jagdalpur (11.29 %) and Rewa (8.31 %).(Table 5.1, 5.2, 5.3)

SM (PP) 302.1: Evaluation of DSN little millet: Out of 26 entries none showed resistance for banded blight and grain smut diseases. (Table 5.6)

SM (PP) 302.2: Evaluation of DSN kodo millet: Twenty eight entries were evaluated against head smut at Jagadalpur and Rewa. At Rewa high incidence (35.77 %) of banded blight was recorded and Jagdalpur recorded highest incidence of head smut compared to Rewa. (Table 5.7)

SM (PP) 302.3: Evaluation of DSN foxtail millet: SiA 2863, SiA 2697, SiA 2657, SiA 2689, GS 889, GS 1329, ISc 1199 showed resistance to brown spot. Moderate resistance was observed in blast and moderate resistance was observed in entries SiA 2863, SiA 2697 and ISc 1199 for banded blight. (Table 5.4, 5.5)

SM (PP) 302.4: Evaluation of DSN barnyard millet: VB-15-2, VB-15-4, VB-16-7, VB-16-20, LRB-19 showed resistance for leaf blight. No entries showed resistance for banded blight disease. (Table 5.8)

SM (PP) 302.5: Evaluation of DSN Proso millet: Eleven entries along with local check were tested against banded blight disease at Vizianagaram and Rewa. Very high incidence was recorded in local check (94.67 %) at Vizianagaram with mean value of 78.79 per cent. (Table 5.9)

4. PP 501: Eco friendly Management of Banded blight/ Sheath blight of Small Millets

Banded blight caused by *Rhizoctonia solani* has been on the rise in most of the small millets especially on the research farms at Vizianagaram, Rewa, Jagadalpur, Ranchi and Ranichauri. As no released variety is resistant to this disease and chemicals for soil borne pathogens in millets (low returns) are not economical it was necessitated for managing the disease through eco-friendly means particularly through the application of bio agents. Buildup of the bio agents in infected soils may be very helpful in gradual reduction of the pathogen population and consequently less disease.

Finger millet: At Vizianagaram, soil application of value added bio-agents *viz., P. fluorescence* + *T. viride* + *B. subtilis* recorded least disease (6.67 %). Both grain and fodder yields were highest with 1651.85 and 4200 kg/ha respectively. (Table 6.1)

Foxtail millet: Lowest banded blight (29.24 %) and highest grain and fodder yields of 1518.52 kg and 2477.8 kg/ha respectively were obtained at Vizianagaram in soil application of value added *P. fluorescence* + *T. viride* + *B. subtilis* as against 63.59 % disease, 1240.74 kg grain and 1148.2 kg fodder yields per ha in check plots at Vizianagaram. (Table 6.2)

Proso millet: Similar results of least banded blight (50.67 %) and higher grain (1573.33 kg) and fodder yields (3040.74 kg/ha) were recorded in the treatment involving soil application of value added *P. fluorescence* + *T. viride* + *B. subtilis* as against 93.33 per cent disease, 966.67 kg grain and 2548.15 kg fodder yields per hectare in check plots at Vizianagaram. (Table 6.6)

Kodo millet: The management trial conducted at three locations Jagadalpur, Rewa and Vizianagaram revealed that, by mean performance, soil application of value added *P. fluorescence* + *T.viride* + *B. subtilis* recorded least incidence of banded blight (22.11 %) besides highest fodder (2695.37 kg/ha). However, highest grain yield was recorded in seed treatment with *P. fluorescence* (1688 Kg/ha). (Table 6.4)

Barnyard millet: At Vizianagaram, soil application of value added *P. fluorescence* + *T. viride* + *B. subtilis* recorded the least incidence of banded blight (64 %) besides highest grain yield (1593 kg/ha). However, highest fodder yield was recorded in seed treatment with *Bacillus subtilis* (3559 Kg/ha). (Table 6.5)

Little millet: By mean performance over four locations *viz.,* Ranchi, Rewa, Vizianagaram and Jagadalpur, soil application of value added *P. fluorescence* + *T. viride* + *B. subtilis* not only recorded least banded blight of 20.78 per cent but also resulted in highest grain and fodder yields of 956.48 kg and2298.70 kg/ha respectively. (Table 6.3)

5. Initiation of basic work on race identification of P. grisea through development of differential set at IIMR, Hyderabad

Blast of finger millet caused by *Pyricularia grisea* is an economically important disease. The first step towards race identification in this pathogen starts with collection of isolates for variability studies. Leaf and neck blast samples were collected from different finger millet growing parts of India. During kharif 2017-18 blast samples ware received from Bengaluru and Mandya in Karnataka, Waghai in Gujarat, Ranichouri in Uttarakhand, Nandyal in Andhra Pradesh and Hyderabad in Telangana. Twenty-six pure cultures were established and preserved representing locations including Bengaluru, Mandya, Waghai and Hyderabad. The schematic diagram given in fig.

1 was followed for development of pure culture from each sample. Culture could not be established from samples received from Ranichowri and Nandyal this year due to contamination in transit.

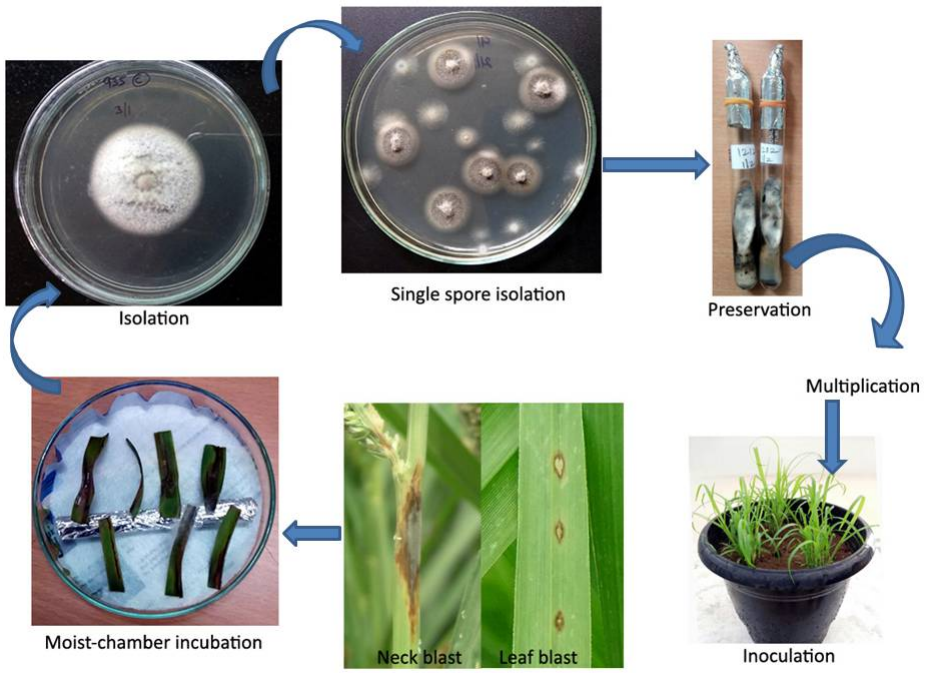

Fig. 1. Schematic diagram for single spore isolation form blast sample followed by inoculation for variability studies.

For variability study each culture was inoculated on 104 selected finger millet genotypes under glasshouse conditions (Fig. 2) and disease reactions were recorded. A few cultures could be studied so far for this year and data analysis will be done after completion of the study.

Fig. 2. Variability study in *Pyricularia grisea* in glasshouse under mist.