SHORT COMMUNICATION

Eliminating Smut (*Moesziomyces penicillariae*) from Pearl Millet Seeds under Transboundary Movement

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Smut of pearl millet caused by *Moesziomyces penicillariae* (Bref.) Venky is a seed-transmitted disease and fungicide seed treatment is not effective in inhibiting viability of smut spores present on seed surface. In the present study sodium hydroxide (NaOH), potassium hydroxide (KOH) and ethanol were tested at three different concentrations (5, 10 and 15%) to prevent the spore ball germination. NaOH and KOH were effective at 10 and 15% concentrations. None of these treatments could completely inhibit germination of spore balls. Spore ball elimination was tried by stirring infected pearl millet seeds for 1, 2 and 3 min with sterilized sand and ethanol. This seed stirring treatment for 2 min. was effective in complete elimination of smut spore balls from pearl millet seed surface. This simple method can be used as a routine treatment in quarantine processing of germplasm and seed certification programmes to prevent spread of pearl millet smut through seed.

Key Words: Ethanol, External contamination, Quarantine, Seed treatment, Spore ball

Smut caused by *Moesziomyces penicillariae* (Bref.) Venky, is a wide spread disease of pearl millet second only to downy mildew causing yield losses up to 10% (Leslie, 2003). Smut is an important disease of pearl millet in northern India particularly in the states of Haryana, Punjab, Gujarat and Rajasthan (Thakur and King, 1988). Bhomik and Sundaram (1971) reported that 50-70% of the crop was infected with smut in some fields with damage up to 100% in individual panicle.

Smut is a floral disease and infection is confined to individual spikelets, often scattered to near base of the earhead. In the field, infected florets are converted into sori, which break at maturity and release brown or black spore balls and healthy seeds get surface-contaminated. These surface-contaminated seeds when used for sowing, the spore balls act as the primary source of inoculum. Fungicides were tried to control pearl millet smut with limited success (Thakur *et al.*, 1992; Yadav and Duhan, 1999). The disease has lot of implications in export of germplasm as countries such as Nigeria and Zimbabwe seek additional declaration that consignment is free from smut. During 2004-2008, a total of 6,253 pearl millet samples have been exported to 31 countries all over the world. Pearl millet smut was also intercepted from the Philippines, Niger, USA and Zimbabwe during import quarantine processing (Chakrabarty *et al.*, 2004). Keeping the importance of the disease in view, the present study was aimed to develop a suitable method for eliminating surface contamination of smut spore balls either by affecting the spore ball germination or by eliminating the spore balls from seed surface so as to facilitate germplasm exchange across the countries.

Infected pearl millet panicles were collected from smut experimental nursery at International Crops Research Institute for the Semi-Arid Tropics, Patancheru. The infected sori were ruptured and spore balls were collected in a glass petri dish under aseptic conditions.

Aqueous solutions of chemicals *viz*., sodium hydroxide, potassium hydroxide and ethanol were prepared at 5, 10 and 15% concentrations to study their effect on spore ball germination. Spore balls and healthy pearl millet seeds were soaked in each concentration of chemical for 2 min. Spore balls were filtered and thoroughly washed in sterile distilled water. These spore balls were suspended in sterile

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distilled water and incubated at 30^0C for 48 h to record the germination. Spore balls soaked in sterile distilled water served as control. Treated pearl millet seeds were sown in sterilized soil to observe effect of these chemicals on seed germination.

Seeds @ 400 for each treatment of healthy pearl millet hybrid, HHVBC Tall-B1 were surface sterilized with 2% Clorax for 2 min. Fifteen smut sori from infected panicles were ruptured on 400 healthy seeds in a Petri plate and mixed thoroughly to get adherence of spore balls on seed surface. Then the seeds in batches were put into a test tube @ 50 per tube along with equal volume of sterilized sand. Five ml of ethanol was added to the test tube and stirred for 1, 2 and 3 min. in a vortex mixture. Seeds were thoroughly washed with sterile distilled water and plated on potato dextrose agar medium amended with carbendazim and thiram mixture (1:1) @ 1g/l and plates were incubated for five days at 30^0C. Observations on colony growth of *M. penicillariae* were recorded using stereo-binocular microscope.

Data presented in Table 1 revealed that seed treatment with NaOH resulted in minimizing spore germination to 11.3, 5.7 and 5.2% at 5, 10 and 15%, respectively, as compared to 15.2% in control. Although KOH at 5% increased spore germination as compared to control, at higher concentrations of 10 and 15%, the spore germination was reduced to 9.7 and 4.4%. Spore germination was more at all concentrations of ethanol (22.5-31.4%). It was observed that pearl millet seed germination was not hampered significantly due to chemical treatment except in 15% NaOH (90%) as compared to control (95%).

In spore elimination study using ethyl alcohol plus sand, no smut spores were found adhering to the seed surface in seed samples stirred for 2 and 3 min., whereas smut colonies appeared on media in seed samples stirred for one min. (10%) and control (90%). The colonies were light yellowish in colour and slimy containing budding sporidia.

Literature review indicated that no fungicide could completely inhibit the viability of smut spores of pearl millet (Yadav and Duhan, 1999). Thiram and captan could reduce spore ball viability from 19.7 to 10.7% and 27.0 to 14.1%, respectively, even after storage for eight months (Yadav and Duhan, 1999). Thakur *et al.* (1992) have reported that carbendazim or vitavax treatment @ 2.5 g/kg of seeds was effective in controlling the inoculum. In this study also complete inhibition of viability of spore balls was not achieved with different chemical treatments. However, no smut spores were found adhering to the seed surface when stirred using ethyl alcohol and sand.

Table 1. Effect of different chemicals on smut spore ball germination

Treatment	Spore ball germination (%)	Seed germination (%)
KOH 5%	17.8	95.0
KOH 10%	9.7	98.3
KOH 15%	4.4	93.3
NaOH 5%	11.3	98.3
NaOH 10%	5.7	95.0
NaOH 15%	5.2	90.0
Ethanol 5%	22.5	98.3
Ethanol 10%	29.7	98.3
Ethanol 15%	31.4	95.0
Control	15.2	95.0
Mean	15.3	95.6
LSD (5 %)	9.13	6.66
F (P)	< 0.001	NS

Thus, seed samples mixed with sand and ethanol and stirred for 2 min. can be recommended for complete elimination of surface contamination of smut spores from pearl millet seed samples. Instead of water, ethanol was used as stirring medium to avert problem of drying of seeds after treatment. Ethanol treatment facilitated quick drying of seed without using seed drier. Similar results were observed by Agarwal *et al.* (1990) for elimination of rust spores from safflower seeds. This simple method can effectively be used especially for germplasm exchange and seed certification programmes.

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