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# EFFECT OF SEEDBORNE FUNGI OF MAIZE ON $Ca^{++}$, $Mg^{++}$ AND $Zn^{++}$ CONTENTS IN THE SEEDLINGS

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When the maize var Ganga Safed seeds were stored with *Aspergillus flavus*, *A. niger* and *Fusarium moniliforme* at 80% RH at 30±0.5°C for 20 days, and their seedlings were raised in purified sand impregnated with Hoagland solution, $Ca^{++}$, $Mg^{++}$ and $Zn^{++}$ were observed considerably less in concentration after 10 days of growth.

**Keywords:** $Ca^{++}$; Maize; $Mg^{++}$; Seedborne fungi; Seedlings; $Zn^{++}$.

Good number of cations have been reported to serve as co-factors[1], and it is also established that besides sugars and amino acids, many anions and cations are lost considerably as leachate from the seed stored with the fungi and as exudate from the root of the seedlings[2].

Fifty g of maize (*Zea mays* L.) var Ganga Safed seeds possessing 94% germinability and containing 8.63% moisture, were surface sterilized using 0.1% mercuric chloride solution for 1 min and washed thrice with autoclaved distilled water. The adherent water was removed with sterilized dry cotton towel and infested with 1 ml of spore suspension in 5% Tween 20 of *Aspergillus flavus* Link ex Fries, *A. niger* Van Tieghem and *Fusarium moniliforme* Sheldon, cultured them on Czapek Dox Agar slants at 30±1°C for 10 days[3]. The number of spores per ml of the suspension was adjusted to nearly 1 x $10^4$ with the help of haemocytometer.

The infested seedlot as noted above and the control without infestation were stored over saturated solution of ammonium sulphate giving 80% RH[3] in sealed desiccators at 30±0.5°C for 20 days. Both the seedlots were surface sterilized as noted earlier and set for germination in sterilized moist blotter at 30±0.5°C. The seeds just germinated, were randomly transferred for culture in prewashed and autoclaved sand kept in plastic mugs. The sand was impregnated with Hoagland solution[4] at the rate of 100g sand and 25 ml solution. The original Hoagland solution was taken in the ratio of 45:5 (A:B) (solution A of macronutrient:solution B of micronutrient) and diluted to 500 ml with autoclaved glass distilled water. The seeded mugs were covered with sterilized thin layer (0.5 mm thick) of moist cotton wool and kept in the laboratory for 120 hr and then shifted to the garden for next 10 days. The sand in the mug was watered every alternate day with 10 ml of the diluted Hoagland solution used earlier to moisten the sand of the culture pot.

The first and the second leaf of the seedlings raised from both the seedlots were randomly taken, cut into pieces and dried at 80°C for 24 hr and cooled over fused calcium chloride for the next 72 hr. The dry leaves were separately powdered in porcelain mortar with pestle. The powdered leaves were again desiccated for 12 hr and 3 g was accurately weighed in electronic balance and ashed in Muffle furnace at 600°C for 2 hr keeping the lot in crucible. The ash produced as a result was dissolved in 1.5 ml of dilute hydrochloride acid (1:3 Acid-Water). 1.5 ml of 0.6% acetic acid was added and the solution was diluted to 500 ml with glass distilled water.

$Ca^{++}$ and $Mg^{++}$ were estimated[5] in the above solution spectrophotometrically at 520 nm[5]. $Ca^{++}$ was estimated using potassium permanganate as reagent while $Mg^{++}$ using Erichrome Black T. $Zn^{++}$ was read[5] at 525 nm using Dithizone (Diphenylthiocarbonate) as reagent. The result was recorded as per cent concentration (Table 1, Fig. 1). It is indicated that the concentration of $Ca^{++}$, $Mg^{++}$ and $Zn^{++}$ were less in the seedlings due to storage of the seeds with seedborne fungi. The minimum concentration of these cations was

**Table 1.** Level of $Ca^{++}$, $Mg^{++}$ and $Zn^{++}$ in the seedlings raised from the seeds stored with seedborne fungi (expressed as % concentration).

| Seedborne fungi | Ca++ | Mg++ | Zn++ |
|---|---|---|---|
| *A. flavus* | 0.005 | 0.035 | 0.006 |
| *A. niger* | 0.011 | 0.059 | 0.013 |
| *F. moniliforme* | 0.031 | 0.050 | 0.031 |
| Control | 0.066 | 0.064 | 0.038 |

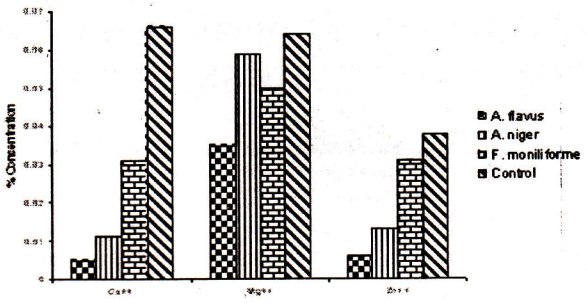


**Fig.1.** Level of $Ca^{++}$, $Mg^{++}$ and $Zn^{++}$ in the seedlings raised from the seeds stored with seedborne fungi (expressed as % concentration).

recorded in the seedlings due to infestation by *A. flavus* followed by *A. niger* and maximum due to infestation by *F. moniliforme*. The seedlings raised from the control seeds possessed maximum concentration of these cations.

Considerably meagre concentration of the noted cations in the seedlings raised from the fungus stored seeds and more in the control, point out either attenuation of the absorptive capacity of minerals by the seedlings or their sluggish ascent to the leaf or both and their excited exudation from the root due to the activity of the storage fungi[6] in comparison to absorption manifesting damage of the plasmamembrane as observed earlier[7] by recording the high value of electrical conductivity of the exudate of mustard seedlings due to storage of the seeds with *Aspergillus flavus*.

The stimulated loss of cations from the seedlings resulting in their meagre amount is expected to disturb the physiology and biochemistry as $Ca^{++}$ is an important ingredient of the middle lamella and plays the role of activator of phospholipase enzyme. Its deficiency leads to retarded cell division also. $Mg^{++}$ is inseparable part of the chlorophyll molecule, and consequently its deficiency leads to chlorosis besides disturbing nucleic acid synthesis and reactions involved in carboxylation and decarboxylation. $Zn^{++}$ is involved in the synthesis of indole acetic acid and protein. The significance noted above and more of these cations has been mentioned earlier[1,8]. The result also points out that *A. flavus* imparted higher degree of deterioration of the seed in comparison to *A. niger* with respect to the content of these cations in the seedlings. *F. moniliforme* inflicted least injury to the seed.

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